

NOMINATION OF JOHN H. GIBBONS TO BE
DIRECTOR OF THE OFFICE OF SCIENCE
AND TECHNOLOGY POLICY

Y 4.073/7:

S. HRG. 103-67

HEARING

BEFORE THE

COMMITTEE ON COMMERCE,
SCIENCE, AND TRANSPORTATION
UNITED STATES SENATE

ONE HUNDRED THIRD CONGRESS

FIRST SESSION

JANUARY 26, 1993

Printed for the use of the Committee on Commerce, Science, and Transportation



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C O N T E N T S

	Page
Opening statement of Senator Burns	5
Prepared statement	5
Opening statement of Senator Hollings	1
Prepared statement	1
Opening statement of Senator Krueger	6
Opening statement of Senator Robb	2
Prepared statement of Senator Rockefeller	32

LIST OF WITNESSES

Gibbons, John H., Nominee to be Director of the Office of Science and Technology Policy	7
Prepared statement, biographical data, and questions and answers	9
Kennedy, Hon. Edward M., U.S. Senator from Massachusetts	3
Prepared statement	4
Warner, Hon. John W., U.S. Senator from Virginia	2

APPENDIX

Posthearing questions asked by, and answers thereto by Dr. Gibbons:	
Senator Burns	50
Senator Pressler	49
Warner, Senator, prepared statement of	49

NOMINATION OF JOHN H. GIBBONS TO BE DIRECTOR OF THE OFFICE OF SCIENCE AND TECHNOLOGY POLICY

TUESDAY, JANUARY 26, 1993

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The committee met, pursuant to notice, at 10 a.m. in room SR-253, Russell Senate Office Building, Hon. Ernest F. Hollings (chairman of the committee) presiding.

Staff members assigned to this hearing: Patrick H. Windham, and Rebecca A. Kojm, professional staff members; and Leslie G. Blossie, minority professional staff member.

OPENING STATEMENT OF SENATOR HOLLINGS

The CHAIRMAN. The committee will come to order, please. We were waiting on our distinguished ranking member, who is coming right along. Senator Danforth will be here in a minute, but we have got some other distinguished Senators that I know are extremely busy.

With our nominee, Dr. Gibbons, let me welcome you. As Dr. Gibbons and I both know, we worked in harness together on the Office of Technology Assessment for the past 13 years. Senator Kennedy, Senator Humphrey, and myself were the original authors on this side, with Emilio Daddario over on the House side. And after Emilio left, Dr. Gibbons took over as the Director there, and has done an outstanding job.

It was in those early days that there were all kind of misgivings by the Members of Congress themselves that we were duplicating things, that we were not really adhering to the mission of technological impact of the various policies of the Congress. And Dr. Gibbons, as a noted physicist and scientist, gave us credibility and continuity and has done an outstanding job, and I think we are very fortunate to have the President select him as Director of the Office of Science and Technology Policy there in the White House.

[The prepared statement of Senator Hollings follows:]

PREPARED STATEMENT OF SENATOR HOLLINGS

This morning we welcome an old friend to his confirmation hearing. Since 1979, Jack Gibbons has served as Director of the Office of Technology Assessment, and over the years those of us who sit on the Technology Assessment Board have come to admire him a great deal.

This morning he comes before the Commerce Committee as the President's nominee to serve as Director of the White House Office of Science and Technology Policy (OSTP).

The Director's position has always been a challenging job, but never more so than today. Three years after the fall of the Berlin Wall, our Government has barely begun the huge task of converting its \$76 billion annual research budget from cold war priorities to today's most urgent needs, particularly economic needs. President Clinton is right: the economy is the issue. If Dr. Gibbons is confirmed, as I expect he will be, he will help the President remold the Federal science and technology establishment to promote long-term economic growth in an increasingly competitive world economy. It is a daunting task—one that will require new priorities, major budget shifts, and new methods of working with industry. The future of our country depends on how well the new administration meets this challenge.

These are issues that we will explore with Dr. Gibbons this morning and, I am sure, in legislative hearings over the months to come.

Dr. Gibbons, it is with great pleasure that we welcome you to this hearing. We would be pleased now to hear from you.

The CHAIRMAN. Let me yield first to Senator Warner.

STATEMENT OF HON. JOHN W. WARNER, U.S. SENATOR FROM VIRGINIA

Senator WARNER. Thank you, Mr. Chairman. Given that I am flanked here by my distinguished colleagues, I will just address part of the biographical data and they can supplement it. As the chairman indicated with a note of humility, you were, together with Senator Stevens, the founders of this concept. And before you today sits a man who has served the Congress very well and very ably, given that the charter that you laid down was a new challenge and I think he fulfilled it.

You mentioned his work here in the Congress and I would pick up, by stating that during the years 1974 to 1979 Mr. Gibbons was a physics professor at the University of Tennessee. He was also the director of the Energy, Environment, and Resources Center at the university.

During the years 1973-74, Mr. Gibbons was the Director of the Office of Energy Conservation at the Federal Energy Administration. He also served as the director of environmental program at Oak Ridge National Laboratory during the years 1969-73. During the years 1954 to 1969 he also served as a physicist and group leader, nuclear geophysics, in the physics division of the Oak Ridge National Laboratory.

I will let my colleague supplement the additional materials. We are also joined this morning by Mrs. Gibbons. They are both residents of The Plains, VA, a small community of one gas station and one general store, so he understands rural America as well as the complex items of science and technology. [Laughter.]

The CHAIRMAN. Good. Well, we welcome Mrs. Gibbons to the committee. Senator Robb.

OPENING STATEMENT OF SENATOR ROBB

Senator ROBB. Thank you, Mr. Chairman. I am delighted to join my senior colleague from Virginia and the senior Senator from Massachusetts, who has a Virginia address while he is applying the efforts of his good office to the people of Massachusetts, in presenting Dr. Jack Gibbons this morning for, I hope, very swift and appropriate unanimous confirmation.

I must tell you that—my distinguished senior Senator has already alluded to some of his out-of-State activities, in addition to the fact that he happens to live in or near the little town of Plains

which the distinguished senior Senator did not mention, but is home to his particular residence as well.

But this distinguished nominee for this particular post both as the President's Science Advisor, which does not require confirmation, and the Office of Science and Technology Policy, happens to have been born in Virginia, happens to have grown up in Virginia, actually in the Harrisonburg area where his father—he was actually a faculty brat, as he describes himself, during that particular period.

And I do not think it requires me to disqualify myself, but in an absolutely delightful conversation yesterday afternoon we discovered that we were related about 200-plus years ago. I think we have a mutual set of great great great great great grand-parents, who happened to have surveyed Augusta County and founded the little town of Staunton.

But beyond that, I think—and I agree with you, Mr. Chairman, this is a superb choice, someone that I think all of the members of the scientific community are going to enjoy working with. His experience has cross a broad array. His background in physics may help him to—help us unlock gridlock here in the Nation's Capitol, but he also has both the basic and the applied sciences. He has a background in a number of areas that are going to be extremely helpful.

But most important, I think, is the fact that he is genuinely interested in working with us and working with others who are interested in advancing science and some of the things that science and technology can do, and I think that this is 1 of those 10 strikes.

I knew Dr. Gibbons by reputation. I really had not had an opportunity to get to know him until yesterday where we had a lengthy conversation about a whole variety of topics, including many that had been of great interest to me, as the distinguished chairman had, in serving as Governor, and so I had a parochial interest and I found that Dr. Gibbons knew all about each of the projects that had been of interest during an earlier period in my own professional career.

But I think this is one of those appointments—and most everyone has had an opportunity to work with him through the Office of Technology Assessment. His new post is going to be one that I am very pleased to join my colleagues in presenting him and recommending him to the committee, and saying that I look forward to working with him on a number of exciting projects that I think are going to advance the cause of science and technology under his leadership.

The CHAIRMAN. Very good. Now senior to all of us, Senator Kennedy.

Senator KENNEDY. Thank you.

The CHAIRMAN. The chairman of our Office of Technology Assessment.

STATEMENT OF HON. EDWARD M. KENNEDY, U.S. SENATOR FROM MASSACHUSETTS

Senator KENNEDY. Mr. Chairman, I thank you for permitting me to join with others in recommending the early and speedy confirmation of Dr. Gibbons. You and Senator Stevens know full well

the extraordinary leadership that he provided in the Office of Technology Assessment. This is a brilliant appointment by the President. He could not have chosen more wisely.

I think Dr. Gibbons, an extraordinary physicist, will bring to his new job an extraordinary array of talents. As OTA Director, he has worked with the Congress extremely well, with Republican and Democrat alike, with the diverse philosophical viewpoints on matters of technology and scientific policy. And I think that the uniform acclamation for Dr. Gibbons demonstrates his ability to find common ground, common understanding, common interests among diversity. That is enormously important.

He also had a brilliant academic career at the University of Tennessee, chairing its Centers on Energy, Environment, and Resources. And then he has worked within the executive branch as the Director of Energy Conservation in an agency that eventually became the Department of Energy.

So, he has had executive experience, the ability and experience of working with the Congress on both sides of the aisle, he has had experience as a researcher and a thinker in terms of public policy, all in the areas of science and technology. And in each and every one of these areas, he has demonstrated excellence and has achieved support from all those that he has worked with.

It truly is an extraordinary appointment. I commend the President for it. We are going to miss him at the Office of Technology Assessment, and hopefully he will not be too far away so that we can draw on his expertise as we in the Congress continue to try to deal with complex technological and scientific issues.

I thank the Chair and I ask that my full statement be put in the record.

[The prepared statement of Senator Kennedy follows:]

PREPARED STATEMENT OF SENATOR KENNEDY

Mr. Chairman, members of the committee, I welcome the privilege of testifying in support of the nomination of Dr. John H. Gibbons to be the Director of the Office of Science and Technology Policy.

For the past 13 years, Jack Gibbons has served with distinction as the Director of the Congressional Office of Technology Assessment. As a member of OTA's Technology Assessment Board, and as its current chairman, I have had the opportunity to work closely with Jack on a wide array of technology-related issues. I come before you today as Jack's colleague, as a great admirer of Jack's professional abilities, and as his friend.

Of course, two members of the committee—the chairman and Senator Stevens—are also members of the Technology Assessment Board, and they know full well of the outstanding job Jack has done at OTA. But with their indulgence, I'll take just a minute to describe Jack's current responsibilities and his attributes.

Congress created OTA in 1972 to provide itself with an objective, expert perspective on the impact of technology on public policy. At the request of congressional committees, OTA prepares comprehensive reports on a spectrum of complex and controversial topics. Recent reports have addressed such topics as emerging defense technologies, computer software and intellectual property, the reliability of polygraphs, and environmental policies in developing nations. I am especially proud of the pioneering work that OTA has conducted on health-related technologies, such as DNA testing for cystic fibrosis and the biological roots of mental illness.

Under Jack's innovative leadership, OTA has come to play an increasingly indispensable role in the legislative process. He has been a major force in shaping the agency, and has helped it grow into the preeminent force it is today in the fields of science and technology.

It is no surprise that Jack has flourished at OTA. He is, as you know, a renowned physicist. Prior to taking the reins at OTA, he served as Director of the Energy, Environment and Resources Center of the University of Tennessee, and as Director of

Energy Conservation for the Federal Energy Administration. So, he already knows his way around the executive branch too.

Based on his admirable record and his broad range of experience, Jack is highly qualified to serve as the President's Science Advisor and as Director of the Office of Science and Technology Policy. In fact, it is almost impossible to imagine a better choice for these sensitive jobs, and it is hard to imagine a nominee who will assume his duties better equipped to hit the ground running than will Jack.

I know I speak for the entire Technology Assessment Board in bemoaning the loss of Jack Gibbons as OTA's Director. His shoes will be hard to fill. But our loss is President Clinton's gain, and the country's gain.

I urge the committee to report this nomination favorably, and I urge my colleagues in the Senate to confirm this fine man as soon as possible so that he can quickly assume the responsibilities that the President has bestowed on him.

The CHAIRMAN. Yes, it will be included. Dr. Gibbons, no one has been better presented. I know these gentlemen perhaps have other commitments, otherwise you are welcome to sit with the committee. If you want to excuse yourselves at this particular time.

Dr. Gibbons, before we hear from you I want to, on behalf of the committee, welcome Senator Krueger, whose outstanding record at Duke and in the House of Representatives and otherwise as a civic leader down there in Texas. I think he is a wonderful appointment and he will make a tremendous contribution, I am sure, to our committee here. And Bob, we are glad to have you.

Senator KRUEGER. Thank you, Mr. Chairman.

The CHAIRMAN. Senator Danforth, did you have any opening comments?

Senator DANFORTH. No, Mr. Chairman.

The CHAIRMAN. Conrad.

OPENING STATEMENT OF SENATOR BURNS

Senator BURNS. I have an opening statement, Mr. Chairman. And just to be real brief about it, I would ask unanimous consent that it be entered in the record. But I think President Clinton has made an outstanding choice here, and I want to thank Dr. Gibbons, before he makes his statement, for dropping by yesterday. And we had a wonderful visit about some areas of concern, the direction which I would want to—or most of us would want to see our technology and R&D go.

And we will have some questions about that, but I would just ask that my statement be made—I think the President has made a wonderful and outstanding appointment here and I plan to support him. Thank you.

[The prepared statement of Senator Burns follows:]

PREPARED STATEMENT OF SENATOR BURNS

Mr. Chairman, I would like to welcome Dr. Gibbons to the Commerce Committee as we consider his nomination to become Director of the White House Office of Science and Technology Policy.

Mr. Chairman, I believe that President Clinton has made an outstanding choice. Since 1979, Dr. Gibbons, as head of the Office of Technology Assessment, has provided Congress with quality analysis on a broad range of science and technology issues. Dr. Gibbons has earned a national reputation as an expert on environmental and energy policy. Now it is the Executive Branch's turn to benefit from Dr. Gibbons' considerable talent and decades of experience.

I cannot overemphasize the importance of the job for which you have been nominated. The Director of OSTP is the highest ranking science official in the Executive Branch and traditionally has served as the President's science adviser. If confirmed, your advice and counsel will be critical in shaping our Nation's science and technology policy. Furthermore, in recent years, the job has taken on even greater im-

portance. The Director of OSTP has been called upon to help plan and coordinate several billion-dollar, multi-agency science programs such as the High Speed Computing and Communications Program and the U.S. Global Change Research Program.

Mr. Chairman, this nomination comes to us at a time when our Nation's economy, national security, communications, transportation, and general welfare depend heavily on advances in science and technology. We look to the biomedical research of institutions like NIH for cures for cancer, AIDS, heart diseases, and other health problems. We rely on the global change research of agencies like NASA and NOAA to help us understand, predict, and address environmental threats to our planet like ozone depletion and global warming. Deploying a Space Station in this decade will depend on meeting technological challenges in life sciences, engineering, and many other areas.

Mr. Chairman, if the past Presidential election was about anything, it was about the economy. A recent GAO study indicated that we are losing ground in all but one of 11 high-tech industries. We have to turn this around. We have to do a better job of converting our scientific inventions and advances into commercial products and services. We have to devote more of our \$76 million R&D budget to commercially relevant research that can jumpstart our economy. We also have to more effectively transfer technology from our national labs and research agencies to U.S. industry, particularly the small businesses who are often operating with 1950s technology. If confirmed, I believe that you must play a critical role in making sure that technology policy is a priority for the Clinton Administration.

Mr. Chairman, another area that I would hope the next OSTP Director would prioritize is communications and computer technologies. As you know, during the last Congress, then Senator Gore and I introduced legislation calling for the development of an advanced broadband communications infrastructure, connecting every home, hospital, school, and business in the U.S. by the year 2015. Communications and computers are going to revolutionize how we live and how we do business. Families will enjoy television on large screens with movie theater resolution and "on-demand" programming. Using special goggles and data gloves, engineers will be able to walk through virtual reality buildings that exist only in the computer. The use of computers in K through 12 education will become commonplace. It is incumbent on the next Director of OSTP to work towards realizing the full potential of these technologies.

I am looking forward to hearing the thoughts and views of Dr. Gibbons on these and other technology issues and I welcome him to this Committee.

Thank you, Mr. Chairman.

The CHAIRMAN. Very good. Senator Krueger, did you have an opening statement?

OPENING STATEMENT OF SENATOR KRUEGER

Senator KRUEGER. Thank you, Mr. Chairman. As one who is 100th in seniority, I am honored to be recognized so early. [Laughter.]

Senator BURNS. That is not so bad. That is where I started. Very few of us, though. It is a chosen club. [Laughter.]

Senator KRUEGER. Many are called and few are chosen. Well, I was chosen by one person. I am going to have to be chosen by a few more 3 months from now. [Laughter.]

But I am delighted, Mr. Chairman, to be serving as a member of your committee, and I delighted that the first person to appear before this committee is one who has a Ph.D. from Duke, where I put in 12 years in that vineyard. And having taught on that faculty for 12 years, I am delighted. I am sorry that we lost recently, we were knocked out of the top five I saw, but we cannot overemphasize that.

I just want to say that given the awesome recommendations you have already received from Senators Robb, Warner, and Kennedy, it would be a bold person indeed who would start off with any tough questions, if he knew them. But I am delighted that someone

who has served with such distinction at OTA should be brought before us. It seems to me a very very strong nomination and I am delighted to have you here.

I would like to ask a few questions at the appropriate time, but at this time I just want to say welcome and we are delighted that you would be considered for this post.

The CHAIRMAN. Very good. Dr. Gibbons, we would be delighted to hear from you at this time.

STATEMENT OF JOHN H. GIBBONS, NOMINEE TO BE DIRECTOR OF THE OFFICE OF SCIENCE AND TECHNOLOGY POLICY

Dr. GIBBONS. Thank you, Mr. Chairman and members of the committee. I would like to submit for the record my introductory statement and simply summarize that for you, so that we might proceed.

The CHAIRMAN. It will be included in its entirety and you can summarize it as you wish.

Dr. GIBBONS. And that statement, Mr. Chairman, also includes a reproduction of the remarks I made when President Clinton introduced me on Christmas Eve, that I thought might be interesting also to the committee.

I am really honored to be here before you. I am deeply grateful for the very generous words that not only you have bestowed upon me this morning, but my two Senators from Virginia and Senator Kennedy. I feel overwhelmed already.

I do feel that I have had an enormously fortunate opportunity to have been immersed in a variety of contexts of science and its companion, technology, through the years. Maybe all of those past experiences are coming together now in a way that was enriched especially by my time in working for Congress, and can be put to use in the administration and working with Congress.

So, I would like to say that I think Mark Twain was right when he said that "education is a progressive discovery of one's ignorance." And I must say that even though I have had a lot of relevant experiences, I still feel less than appropriately prepared for the kind of challenges that are before me. But I am going to do my best, and I hope it will be satisfactory to my boss down the street, as well as to the Congress.

Let me talk just a moment about my credentials as they relate to the job requirements of Assistant to the President for Science and Technology, and also Director of the Office of Science and Technology Policy.

First, the person must have a broad and current understanding of science and technology, as they affect and are affected by public policy. In addition, he or she must have an ability to translate complex technical concepts into language readily understandable to our citizen Governors.

Not many of us have a technical background and have found our way into public policy. In this time of very complex and specialized knowledge, it is important for some of us to play the role of translator, to provide, as James Madison called it, "the power that knowledge gives," to our lay Governors. I think my nearly 14 years of work at OTA really helped me prepare to fulfill that requirement.

A second requirement is an ability to understand the very specialized languages and the concerns of people who have different perspectives and responsibilities. The person must have an ability to listen carefully, to reconcile and to integrate different points of view into a consensus that enables action.

That ability will be required of me as I work with the various executive agencies that share responsibility on a large number of issues before us today. The intent is to provide the kind of catalytic glue that brings the departments together, perhaps in a better way than we have done it before, so that the whole is greater than the sum of the parts.

A third requirement is an ability to understand both the context and the process of science itself. I will use this office not to represent the cause of science so much as to represent its processes and context. Government needs individuals who understand science's fundamental importance in the American experiment, both in our pursuit of knowledge—an explicit national goal—and in the application of knowledge to help fulfill human needs and aspirations. I think the 15 very happy years I spent at the bench as a scientist constitute an important part of my background as I try to both understand and represent that perspective.

The fourth requirement is an appreciation of what it takes to transform a technical innovation into a product. It represents a significant step beyond the lab to make something, to satisfactorily manufacture, sell, and service a product while generating sufficient profit to stay ahead of the inevitable competition.

This kind of business experience, which I have been privileged to have in past years is essential for someone designated to assist the administration in engaging these twin enterprises of science and technology in meeting national goals.

Last, I have had the good fortune of being repeatedly exposed to the universality of science, the inherent and accelerating mobility of information around the globe, and therefore of the folly of thinking about science and technology in anything less than its total international context. It is all too easy to think about these things in national terms, but we must always think of them in an international context.

While the challenges before me are daunting, I do feel highly fortunate to have had these relevant prior experiences. In times past I have often wondered what I would want to be when I grow up. At one time I thought, well, the secret to that is just not to grow up. But I now believe that this job before me is what I want to be when I grow up. I hope to combine my past experiences in new ways to help our Nation capture the opportunities provided by science and technology in fulfilling our many national aspirations.

Now for just a couple of words about the office, Mr. Chairman. The National Science and Technology Policy, Organization, and Priorities Act of 1976, wisely provides considerable flexibility to the President and to the Director in organizing and utilizing resources. To be effective, I think we all understand that each President needs to be able to organize the White House in his own way.

President Clinton, I am confident from my direct conversations with him, fully appreciates the fundamental and growing role of science and technology in assuring our national future. Over the

past weeks I have been frequently consulted in my new capacity about candidates for science and technology positions in various Departments of Government. If confirmed I look forward to organizing the OSTP in a way that builds on the impressive progress of my colleague Allan Bromley over the past 4 years.

I want to be a catalyst for improved integration of science and technology across the executive branch. I also want to build a more effective partnership between the administration and Congress, as well as with key institutions outside the Federal Government. Our combined wisdom, strengths, and resources are enormous, but so too are the challenges we face. You know all too well that it is so important that we work closely together to define achievable goals and equitable means to reach them. It sounds simple, but it is not an easy task, and science and technology are ubiquitous in the process.

In closing, I want to commend this committee particularly for its leadership in promoting national progress through the support of various innovative ways to encourage technology, to encourage training, and to develop new partnerships between the public and the private sectors.

Also, Mr. Chairman, I want to report that in my disclosure of assets to the committee, my wife and I neglected to list our most valuable assets of all, our children. Our three daughters have followed different pursuits in their adult lives, and they have found full measures of success in their professional and family lives. So, I must report to you this morning that they were missing on my form, but I treasure them most highly of all.

Thank you, Mr. Chairman.

[The prepared statement, biographical data, and prehearing questions and answers of Dr. Gibbons follow:]

PREPARED STATEMENT OF DR. JOHN H. GIBBONS

Mr. Chairman and members of the committee, I am honored to appear before you today. I am also deeply grateful for the generous words of support from Senator Kennedy as Chairman of OTA's Technology Assessment Board, and to Senators Robb and Warner for introducing me as a son of Virginia. I earnestly hope that, if confirmed, I will be able to put to the best possible use the experiences which I have had to date and to measure up to the needs and expectations of the position to which I have been nominated by President Clinton.

Let me first address my credentials in terms of the requirements of the combined position of Assistant to the President for Science and Technology and Director of OSTP.

The first requirement is a broad and current understanding of science and technology as they affect National policy and are affected by it; plus an ability to translate key technical complexity into readily understandable language. I believe my background of nearly 14 years at OTA has provided me a splendid preparation. While at OTA I broadened my perspectives of issues to include not only science and technology but also economic, political, and ethical perspectives. For example, the subject of biotechnology includes not only molecular biology, genetic engineering and the like, but also economics, ethics, privacy, property rights, and public acceptability. This broad perspective, to me, is an essential requirement for the task of giving advice to the President.

A second requirement is an ability to understand the specialized languages and concerns of people who have different perspectives and responsibilities, plus an ability to listen carefully, to reconcile and integrate different points of view into sufficient consensus that enables action to follow. This ability is required, for example, to forge policies and decisions across the executive agencies, particularly for Administration initiatives that require coordinated participation by several Departments. I believe that my career at the Oak Ridge National Laboratory where we first established research programs that integrated physical science, engineering, political and

social science into interdisciplinary work on energy conservation taught me a lot in this regard. So, too, did my service as Director of the interdisciplinary Energy, Resources, and Environment Center at the University of Tennessee, and my service on various committees and study groups with the National Academy of Sciences, Aspen Institute, OTA, and others during the 1970's.

A third requirement is an ability to understand both the context and process of basic science. I feel enormously fortunate to have had a broad education in science and more than 15 happy and productive years "at the bench" as a researcher in nuclear structure and stellar nucleosynthesis.

A fourth requirement is an appreciation of what it takes to transform a technical innovation into a product, and to successfully manufacture, sell and service it, while generating sufficient profit to stay ahead of the inevitable competition and have a little left over. This kind of "business" experience is, it seems to me, essential in order for me to assist the administration to engage the twin enterprise of science and technology in meeting national goals. My experience during the 1960's and 1970's in creating new businesses and serving on various Boards of Directors has been invaluable in helping frame my perspectives. I believe that experience will serve me well as I work with the President to build new, productive bridges of co-operation and coventuring between the private sector and the people of this nation.

Lastly, I have had the good fortune of being repeatedly exposed to the inalienable facts of the universality of science, the inherent and accelerating mobility of information around the globe, and therefore of the folly of thinking about science and technology in anything less than its international context.

Thus, while the challenges before me are daunting, I do feel highly fortunate to have such relevant prior experiences. In times past, I've frequently wondered what I wanted to do when I "grow up". Now I believe this new job is just that, since it will draw so completely on my past experiences.

Mr. Chairman, the National Science and Technology Policy Organization and Priorities Act (PL94-282) which created the OSTP wisely provides considerable flexibility to the President and the Director in organizing and utilizing the Office. To be effective, each President needs to be able to organize the White House in his own way. President Clinton appreciates fully the fundamental and growing role of science and technology in assuring our nation's future. I have already been frequently consulted about candidates for science and technology positions in various Departments. If confirmed, I look forward to organizing OSTP in a way that builds upon the impressive progress made by my distinguished predecessor, Dr. D. Allan Bromley. I hope not only to be a catalyst for improved integration of science and technology across the Executive Branch, but also to build a more effective partnership between the Administration and Congress as well as with key institutions outside the Federal government. Our combined wisdom, strengths, and resources are enormous, but so are the challenges we face. That is why it is so important that we work closely together to define achievable goals and means to reach them that are equitable. Science and technology are ubiquitous means to those ends. That is why I am prepared to totally commit myself to this task.

Before I close, I want to commend the Committee for its leadership in promoting national progress through the support of various innovative ways to encourage technology, training, and new partnerships between the public and private sectors. I also want to report that in my disclosures of assets to the Committee, my wife and I neglected to list our most valuable of all: our children. All three daughters followed different pursuits and have found a full measure of success in professional and family life.

JANUARY 26, 1993—STATEMENT MADE BY DR. JOHN H. GIBBONS ON 12/24/92 ON THE OCCASION OF THE PRESS BRIEFING BY PRESIDENT-ELECT BILL CLINTON

I am delighted to accept the opportunity to serve the Clinton/Gore administration by helping coordinate the federal science and technology enterprise. Our security and prosperity depend, as never before, on the sustained support of science and the thoughtful use of technology.

I stress both science and technology because they are so interdependent. They sustain each other; neither can advance without the help of the other.

Carefully chosen, technology provides options—options to enable economic progress, protect environment and health, and assure national security. And science plays an increasingly central role in our traditional national support of exploration, to better understand who we are, the world around us, and how things work. Thus, we place very great weight on the intrinsic value of basic science, out of which has flowed extraordinary and often unanticipated benefits to society, including enormous

enrichment of the human spirit. And there is certainly no end in sight. Listen to Oliver Wendell Holmes:

"True science knows no bounds. It penetrates into every domain without fear and serves all men without prejudice or favor. Its work is to substitute facts for appearances, demonstrations for impressions, and beneficial realities for those many things ignorance and greed proclaim to be impossible. For suffering humanity, it is hope and promise."

There is an old Chinese proverb that goes, "the more you say the less people will remember." Thus I conclude with kudos to OTA's Technology Assessment Board, for 13 years of bipartisan support through thick and thin; to OTA's outstanding staff and the rich experiences I shared with them; to my many splendid friends who shared this quest; and to my family whose love, support and toleration sustains me.

BIOGRAPHICAL DATA

Name: Gibbons, John "Jack"; address: P.O. Box 497, The Plains, VA 22171; business address: Director, Office of Technology Assessment, U.S. Congress.

Position to which nominated: Director, Office of Science and Technology Policy, Executive Office of the President.

Date of birth: January 15, 1929; place of birth: Harrisonburg, VA.

Marital status: Married; full name of spouse: Mary Ann Hobart Gibbons; names and ages of children: Virginian Neil Gibbons Barber, 4/1/56; Diana Conrad Gibbons Alber, 9/20/57; and Mary M. Gibbons Gabris, 5/13/60.

Education: Duke University, 6/49-11/54, Ph.D., 1954; and Randolph-Macon College, 6/46-6/49, B.S., 1949.

Employment: 6/79-present, Office of Technology Assessment, Director; 6/74-5/79, Energy, Environment & Resource Center, University of Tennessee, Director; 9/73-9/74, Office of Energy Conservation, Director; 1969-73, Environmental Program, Oak Ridge, TN, Physicist; and 1954-69, Nuclear Geophysics, Oak Ridge, TN, Physicist.

Government Experience

Name of organization	Year	Nature of affiliation	Location
American Association for the Advancement of Science.	1960-present	Fellow (1970), board member (1988-91).	Washington, DC.
American Physical Society	1953-present	Member/Fellow; member, Awards Committee (1992).	Do.
Aspen Institute for Humanistic Studies.	1978-present	Member, Energy and Resources Committee; 1981-84, Chairman, Steering Group.	Aspen, CO.
Atomic Energy Commission	1968-70	Member, Advisory Committee on Neutron Cross Section.	Washington, DC.
Carnegie Commission on Science, Technology, and Government.	1990-92	Member, Task Force on Long Term Goals and Priorities in Science and Technology.	Do.
Common Cause	1970-present	Member	Do.
Cosmos Club	1972-present	Member	Do.
Council on Foreign Relations	1990-present	Member	New York, NY.
Energy Opportunities Consortium	1976-79	Member, Policy Committee	Knoxville, TN.
Energy Foundation, the	1990-present	Member, Board of Directors	San Francisco, CA.
Energy Systems & Policy Journal	1976-present	Member, Board of Directors	New York, NY.
Environmental Systems Corporation ...	1976-79	Member, Board of Directors	Knoxville, TN.
Electric Power Research Institute	1986-present	Advisory Council Member	Palo Alto, CA.
Fauquier County, VA	1990-91	Chairman, Citizens Advisory Committee on Waste Management.	Warrenton, VA.
Federation of American Scientists	1953-present	Member	Washington, DC.
Georgetown University	1977-79	Co-Vice Chairman (Industry), Task Force on Fuel Utilization and Conservation, National Coal Policy Project, Center for Strategic International Studies.	Do.
Honor Societies:			
Phi Beta Kappa	1949	Member	Lexington, KY.
Phi Beta Kappa Associates	1990	Do	Do.
Omicron Delta Kappa	1948	Do	Do.

Government Experience—Continued

Name of organization	Year	Nature of affiliation	Location
Sigma Pi Sigma	1948	Do	Research Triangle Pk.
Pi Mu Epsilon	1948	Do	Do.
Pi Gamma Mu	1948	Do	Do.
Sigma Xi, the Scientific Research Society.	1951-present	Member, inducted at Duke University; 1978-79, National Lecturer; 1989-present, Member, Long Range Planning Committee.	Do.
International Energy Exposition (World's Fair).	1978-82	1978-79, Board of Directors; and 1979-82, Chairman, Energy Commission and National Advisory Council.	Knoxville, TN.
James Madison University	1989-90	Member, Blue Ribbon Advisory Panel on Proposed College of Applied Science and Advanced Technology.	Harrisonburg, VA.
McDowell Enterprises, Inc.	1977-79	Member, Board of Directors	Nashville, TN.
Middleburg Tennis Association	1985-present	Member	Middleburg, VA.
National Academy of Engineering	1984-93	Member, Steering Committee, Symposium Series on Technology and Society.	Washington, DC.
National Academy of Sciences	1976-87	1977-78, Chairman, Panel on Energy, Natural Resources, and Environment, NAS Study on the U.N. Conference on Science and Technology for Development; 1976, Member, Committee on Measurements of Energy Consumption; 1979-87, Member, Board on Science and Technology for International Development; and 1976-79, Chairman, Demand and Conservation Panel, Committee on Nuclear and Alternative Energy Systems (CONAES).	Washington, DC.
National Science Foundation	1978-79	Advisory Panel, Division of Policy Research and Analysis.	Do.
Nature Conservancy	1972-present	Member	Arlington, VA.
ORTEC	1962-68	Founder, Board of Directors	Oak Ridge, TN.
Piedmont Environmental Council	1986-present	Member	Warrenton, VA.
Randolph-Macon College	1977-83	1977-79, Member, Board of Trustees; 1980-83, Board of Associates; and 1980-83, Chairman, Board of Associates.	Ashland, VA.
Resources for the Future	1983-92	Member, Board of Directors	Washington, DC.
Save Our Cumberland Mountains	1972-present	Member	Jacksboro, TN.
Sierra Club	1955-present	Do	San Francisco, CA.
Smithsonian Luncheon Club	1988-90	Do	Washington, DC.
Stanford University	1980-present	1984-89, Member, School of Engineering Advisory Council; and 1980-present, Member, Senior Advisory Panel, Energy Modeling Forum.	Palo Alto, CA.
Tennessee Citizens for Wilderness Planning.	1965-present	Member	Oak Ridge, TN.
Tennessee Energy Authority	1976-79	Member, Board of Directors	Nashville, TN.
University of Tennessee	1985-present	Member, Editorial Board, Forum for Applied Research and Public Policy (Journal), c/o Energy, Environment and Resources Center.	Knoxville, TN.
U.S. Department of Commerce	1992-present	Member, Nominating Committee, 1993 President's National Medal of Technology.	Washington, DC.

Government Experience—Continued

Name of organization	Year	Nature of affiliation	Location
U.S. Department of Energy	1976-79	1978-79, Member, Energy Research Advisory Board; 1977-79, Chairman, Advisory Committee, Energy and Environmental Systems Division, Argonne National Laboratory; and 1976-78, Member, Advisory Committee, National Center for Analysis of Energy Systems, Brookhaven National Laboratory, Chairman, 1977.	Do.
U.S. Environmental Protection Agency	1989-91	Member, International Environmental Technology Transfer Advisory Board (IETTAB).	Do.
U.S. National Bureau of Standards	1976-79	Member, Advisory Committee, Energy Conservation Programs.	Gaithersburg, MD.
UT Arboretum Society	1964-present	Member, Board of Directors (1983) ...	Knoxville, TN.
Virginian Native Plant Society	1988-present	Member	The Plains, VA.
Wilderness Society/Conservation Foundation.	1957-present	Do	Washington, DC.

Political affiliations: None.

Honors and awards: 1992 AAAS Philip Hauge Abelson Prize, for a public servant, in recognition of sustained exceptional contributions to advancing science; Officer's Cross of The Order of Merit, Federal Republic of Germany (1991); 1991 Leo Szilard Award for Physics in the Public Interest, American Physical Society; 1990 Public Service Award, Federation of American Scientists; Fellow, American Association for the Advancement of Science; Fellow, American Physical Society; Sigma Xi National Lecturer, (1978-79); Distinguished Service Award, Federal Energy Administration (1974); and Phi Beta Kappa, Sigma Xi, Omicron Delta Kappa, Sigma Pi Sigma, Pi Mu Epsilon, Pi Gamma Mu.

Published writings: Dr. Gibbons is the author of numerous published articles dealing with energy and environmental policy, energy supply and demand, conservation, technology and policy, resource management and environmental problems, nuclear physics and origins of solar system elements.

PUBLICATIONS

1. Gibbons, J.H., "Decisionmaking in the Face of Uncertainty," Conference on Energy & Environment: Intersecting Global Issues, January 17-18, 1992, University of Arizona, Tucson, AZ. Co-sponsored by the University of Arizona College of Law and the College of Engineering, and the Udall Center for Public Policy.
2. Gibbons, J.H., "Overview of Conference Outcomes and Conclusions from & Policy Analysis Perspective," December 9-11, 1991, IEA/OECD/NOVEM Executive Conference on Energy Technology Policy for Sustainable Development; Comparing Long-Term Approaches, Noordwijk, the Netherlands.
3. Gibbons, J.H., "Implementation: Science & Technology, Proceedings of Sigma Forum, "Global Change and the Human Prospect: Issues in Population," Science, Technology and Equity, Washington, D.C., November 16-18, 1991.
4. Gibbons, J.H., "Governing In a Technology-Driven Age: Progress and Problems," Washington University in St. Louis, Third Annual Elvera and William Stuckenberg Lecture in Technology and Human Affairs, October 21, 1991.
5. Gibbons, J.H. and Blair, Peter D., "U.S. Energy Transition: On Getting From Here to There," Physics Today, July 1991.
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8. Gibbons, J.H., "Science, Technology, and the Law in the Third Century of the Constitution," National Forum, vol. LXXI, no. 4, Fall 1990.
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10. Gibbons, J.H., "Role of Analysis in Government," *Midcontinent Perspectives*, April 9, 1991.
11. Gibbons, J.H., "Energy in the Environment: Sinner or Savior?" "Our Fragile Earth: Strategies for Survival," Tenth Annual Providence Journal/Brown University Public Affairs Conference, February 26-March 13, 1990.
12. Gibbons, J.H., "The Interface of Environmental Science, Technology, and Policy," *Energy and the Environment in the 21st Century*, Proceedings of the Conference held at the Massachusetts Institute of Technology, Cambridge, MA (March 26-28, 1990).
13. Blair, P.D., and Gibbons, J.H., "Energy Efficiency: Its Potential and Limits to the Year 2000," *Energy: Production, Consumption, and Consequences*, John L. Helm, ed. (Washington, DC: National Academy Press 1990). Based on NAS symposium to celebrate the opening of its Arnold and Mabel Beckman Center in Irvine, California.
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 61. "Trends in Energy Costs" in *Proceedings of the Purdue Energy Conference of 1977*. Held at Purdue University, West Lafayette, Indiana, April 29–30, 1977.
 62. "Gibbons: Big Savings in Energy Use Still to Come" in *Energy Efficiency Research*, a publication for sharing information on new technology developments in energy conservation. Published by the Energy Research and Development Administration. February, 1977.
 63. "Energy Conservation and the National Energy Outlook: 1976." Discussion paper prepared for the R.F.F. Workshop on the National Energy Outlook, Reston, Virginia, August 15-17, 1976, sponsored by FEA and NSF. Review of Federal Energy Administration National Energy Outlook, 1976. Hans H. Landsberg, Editor. A Report to the National Science Foundation under Proposal No. 7680248, March 1977, Resources for the Future, 1755 Massachusetts Ave., N.W. Washington, D.C.
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- February 26-March 13, 1990. Brown University Public Affairs Conference. "Our Fragile Earth: Strategies for Survival."
- March 26-28, 1990. Proceedings of the Conference held at the Massachusetts Institute of Technology, Cambridge, Massachusetts. "The Interface of Environmental Science, Technology, and Policy."
- March 29, 1990. Grace Episcopal Church, The Plains, Virginia. "Christian Environmental Stewardship at the Millennium."
- April 5, 1990. Environmental and Energy Study Institute, Washington, D.C. Earthtech 90 International Forum. "Energy for Environmentally Sustainable Development."
- May 2, 1990. Foreign Policy Association, New York, New York. "Technology the Law."
- May 14, 1990. Institutional Investigatory Institute, New York, New York. "American Competitiveness: Government/Industry Partnerships?"
- September 5, 1990. Mitre Corporation, McLean Virginia. "On Sacred Fires, Faustian Bargains, and Social Contracts."
- October 27, 1990. Symposium in Honor of Harvey Brooks, Harvard University, John F. Kennedy School of Government, Cambridge, Massachusetts. "Technology Assessment."
- November 9, 1990. The President's Circle, National Academy of Sciences, Washington, D.C. "National Priorities and Their Implications for Energy Policy."
- November 14, 1990. U.S. Council for Energy Awareness, Washington, D.C. "On relieving U.S. Oil Dependence."
- December 12, 1990. National Conference on State Legislatures, Washington, D.C. "Can the U.S. Wean Itself from Imported Oil?"
- January 22, 1991. Competitive Power Policy Forum, Washington, D.C. "Energy Perspectives."
- March 5, 1991, COMSCI Fellows Orientation, U.S. Department of Commerce Untitled.
- March 11, 1991. National Management Association, Martin Marietta Energy Systems, Oak Ridge, Tennessee. "Energy, Environment, Economy, and Security."
- February 26, 1991. Parliamentary Scientific Committee, United Kingdom (London: Savoy Hotel), "Technology Assessment and Wise Governance."
- March 17, 1991. Grace Episcopal Church, The Plains, Virginia. "NES and Stewardship."
- April 5-7, 1991. First DeLange Conference, Rice University, Houston, Texas. "What Can We Learn from the Amoeba?"
- April 22, 1991. American Physical Society Spring Meeting. "On Taking Horses to Water."
- May 7, 1991. Council of Scientific Society Presidents. "What Can We Learn from the Amoeba?"

- June 11, 1991. Conference on Technologies for a Greenhouse-Constrained Society, Oak Ridge National Laboratory, Oak Ridge, Tennessee. "Governance and Growth in a Greenhouse."
- June 17, 1991. NRC/AID Luncheon Seminar, Washington, D.C. "Energy in Developing Countries."
- June 21, 1991. Alfred University, Alfred, New York. "The Federal Government's Role in Advancing Technology."
- September 12, 1991. Business Week/McGraw Hill Conference on Information Highways, New York, New York. "Critical Links to the Future: a Report to Congress."
- September 23, 1991. MILLERCOMM92, University of Illinois at Urbana-Champaign. "Science and Technology: Opportunities and Challenges for Governance."
- October 10, 1991. Clean Sites, Alexandria, Virginia. "Public-Private Cooperation in Innovative Technology."
- December 8, 1991. Netherlands Study Centre for Technology Trends. The Hague. "Overview of Conference Outcomes and Conclusions from a Policy Analysis Perspective," IEA/OECD/NOVEM Exec. Conference on Energy Technology Policy for Sustainable Development: Comparing Long-Term Approaches.
- January 8, 1992. MITRE Institute, Mclean Virginia. "The Office of What?"
- March 2, 1992. CONSCI Fellows Orientation, U.S. Department of Commerce, Washington, D.C. Untitled.
- March 27, 1992. "EFRI-Stanford symposium in honor of Chauncey Starr, "Energy, Risk, and the Environment."
- December 11, 1992. Netherlands OTA, Amsterdam. "Technology Assessment and Politics." Annual Invited Rathenau Lecture.

QUESTIONS ASKED BY SENATOR HOLLINGS AND ANSWERS THERETO BY DR. GIBBONS

Question 1. What do you consider to be the Nation's most pressing science and technology issues, and what will be your highest priorities should you be confirmed as Director of the Office of Science and Technology Policy (OSTP)?

Answer. I believe this Nation must better link its scientific and technological enterprise to national goals. Science and technology have much to contribute to achieving President Clinton's stated goal of reestablishing the strength and resilience of the American economy: the development and adoption of new technologies by U.S. businesses can create attractive new job opportunities; advancing learning technologies and complementary curricula and standards can ensure that all Americans have access to the skills in mathematics, science, and technology needed in a modern economy; and new technologies can contribute to rapid economic growth while limiting unwanted environmental impacts. Science and technology also have much to contribute to other national goals, such as improved health care and environmental quality.

To help ensure that science and technology fulfill their potential in national affairs, if confirmed I will work with the President, the Vice President, and the Cabinet members toward:

- preserving U.S. leadership in basic scientific research;
- better integrating environmental and economic goals (on a national and international level) and developing strategies for reaching those goals;
- establishing the Federal Government as a leader in resource efficiency and sustainable living; and
- educating and training the American population in preparation for the 21st Century.

Question 2. If confirmed, what do you see as your most important responsibilities? Will you play an active role in working with the Office of Management and Budget (OMB) to advise the President on budget priorities for Federal research and development (R&D)? What kinds of criteria should be used to evaluate competing big science and technology projects, and what would you envision your role to be in such a process?

Answer. My major responsibilities, if confirmed, will be to ensure that science and technology are directed toward achieving overarching societal goals, including the pursuit of knowledge. Linking S&T to national goals will promote a strong and resilient S&T base and allow us to maintain a balance between continuity and flexibility in our future policies.

OSTP has a special responsibility to coordinate multi-agency R&D activities, and only OMB and OSTP review the entire Federal R&D portfolio for the Executive Branch. I anticipate working closely with OMB to: 1) assist the President and Vice

President in knitting together coherent policies and programs with respect to S&T; 2) ensure a cooperative relationship between the Executive and Legislative Branches in authorizing and funding S&T; and 3) collect and synthesize the wisdom of our colleagues outside of government—in industry and academia, here and abroad—regarding the linkage between the S&T base and the economy.

The primary criterion for judging a major science or technology project is whether and how the project furthers accomplishment of a national goal, a task for which OSTP is well suited. With that established, it will be necessary for the Administration to determine its priorities—a task that ultimately lies at the feet of elected officials, but one in which OSTP can play a critical information gathering and analysis role. Big projects generally serve more than one goal, and science is but one voice among others in the final determination on relative merit. But OSTP can help ensure that accurate, impartial scientific information is available in such situations. OSTP must also ensure that even though public enthusiasm for a particular goal or a given project may wax and wane, the Nation maintains a strong S&T base, through continuing, reliable funding for basic scientific research.

Question 3. More and more, the Nation is faced with scientific and technological challenges that are too complex to be dealt with by a single Federal agency. To provide a framework for interagency policymaking, the 1976 Science and Technology Act created the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), which the OSTP Director chairs. How active a role should FCCSET play in coordinating interagency programs? For example, the Committee on Earth and Environmental Sciences (CEES) has worked closely with OMB in the global change research area to coordinate agency budgets and prepare an interagency strategy. Should other FCCSET committees be as active as CEES and prepare similar interagency strategies?

Answer. FCCSET has been an effective coordinating tool in some instances. I intend to help the President and Vice President make FCCSET an effective management tool as well for implementing Administration policy. By closely coordinating the FCCSET process with the Administration's budget process, this Administration will develop a series of strategies for particular aspects of science and technology that will be reflected in agency budgets and priorities. The mechanism will be used to develop coordinated research and regulatory programs capable of achieving objectives, such as using the resources of many Departments and Agencies to achieve environmentally sustainable economic growth while reducing the regulatory and financial burden borne by individuals and small businesses.

Question 4. One important interagency science issue is research into global change. More than a dozen Federal agencies conduct research on global warming, ozone depletion, and other global environmental problems. If confirmed as OSTP Director, what will you take to ensure that policymakers have the scientific information about global environmental change that they need to make effective policy? How well has FCCSET's CEES been coordinating the Federal global change research program? Over the long term, can an interagency committee provide adequate coordination?

Answer. Coordinating Federal global climate change research will be one of OSTP's highest priorities. I expect to have one of the new Associate Directors of OSTP assigned to Environment. The FCCSET/CEES mechanisms has been effective but could be much improved. I will work to improve the way research on climate change is managed in the Federal Government. I will also work to improve management of Federal programs designed to develop and accelerate the adoption of technologies that permit rapid economic growth without damaging the global environment. I hope to look to this Committee and others in Congress for help in doing this.

Question 5. Since 1981 the world has changed greatly in at least three ways: East-West military tensions have declined, international economic competition increasingly is seen as the greatest challenge facing the United States, and evidence has mounted that human pollution is causing major changes in the world environment. How should Federal R&D policy respond to these major new trends? First, what are the R&D implications of reduced military tensions? Second, at a time when Japan and the European Community invest most of their government R&D funds in non-defense areas related to industrial competitiveness, should the United States not increase its Federal R&D budget for industrial development? Third, is new R&D needed to give the United States new scientific understanding and technologies needed to respond to world environmental problems?

Answer. National policy in science and technology needs to be carefully redefined to reflect the challenges to the U.S. economy and a new range of U.S. security interests. I hope to work closely with this Committee and others in the Congress to help the Clinton/Gore Administration shape new policies.

The declining importance of East-West confrontation creates a need for defense forces that can respond to diverse threats in many parts of the world. We need to maintain technological superiority in many areas and a high level of readiness training. With a well managed program, as defense spending declines, increased investment in civilian technology can support defense interests by fostering U.S. industries that lead the world in technologies critical to military and civilian economies.

Encouraging no defense research to promote industrial competitiveness requires more than increasing federally sponsored research. It also requires policies and programs that encourage higher levels of private spending in research and development and that encourage U.S. businesses to move quickly to invest in innovation. We must also ensure that U.S. students emerge from school adequately prepared to participate in a sophisticated, fast-moving economy and also that people already in the workforce have access to the training needed to keep pace. Our Japanese and European competitors clearly understand this.

New R&D and enhanced international cooperation are needed to improve our understanding of world environmental problems and to help us respond with new and existing technologies. The United States can do tremendous good for the global environment by helping the developing world adopt some of the cutting-edge technologies available today and leap-frog some of our technological mistakes. We can also support research and delivery programs for maternal and child health and family planning that can have an immediate and direct impact on peoples' lives and their ability to care for their environment.

Question 6. The United States faces a great irony. It leads the world in Nobel Prizes, but other countries excel at turning these American ideas into successful new products. It leads in science but now lags badly in many areas of technology. If confirmed, will you recommend greater Federal support for basic technology? In particular, will you recommend increasing the budget of the major civilian technology agency, the National Institute of Standards and Technology (NIST)? In this regard, what priorities do you believe NIST should pursue?

Answer. The U.S. economy has suffered because of its inability to translate the results of its world acclaimed research into profitable products. The Clinton/Gore Administration will offer a range of policies designed to stimulate business innovation and growth throughout the economy. NIST has played an active and important role in developing technologies that help our industries compete and help ensure that all American businesses, particularly small businesses, have practical access to innovations. During the campaign, President Clinton proposed to double the NIST budget. Technology programs at NIST and elsewhere need to be carefully coordinated with research programs conducted throughout the government. They also need to be better interfaced with private industry.

Increased technology activity at NIST is particularly important in ensuring continuity of support for research and development as defense budgets decline. We will also need to find improved ways to use the resources at our national laboratories to support civilian technological and scientific research. OSTP can play an important role in accelerating and coordinating this thrust across the government.

Question 7. Manufacturing remains central to the American economy; today it provides approximately 25 percent of U.S. jobs. Yet at a time when the United States trails Japan in manufacturing technology and operations, the total Federal civilian R&D budget for manufacturing is much smaller than other expenditures. What priority should be placed on the Nation's technology base in manufacturing?

Answer. Many American jobs depend directly or indirectly on our ability to compete internationally in manufacturing. Unfortunately, the United States has been losing world market share in manufacturing.

The Administration has already announced its intention to initiate and manage a vigorous set of programs to foster technological development in manufacturing and to enact a solid program for encouraging U.S. manufacturers to convert technology into profitable business opportunities. For example, the Clinton-Gore campaign's policy paper on manufacturing called for creating 170 "market-driven manufacturing centers to help small- and medium-sized manufacturers."

Question 8. The Commerce Committee has heard complaints from American researchers about fluctuations in research funding levels. Of course, most researchers would like more funding for their fields of study, but understand the need to control Federal spending and reduce the deficit. What concerns them are unpredictable swings in funding levels from year to year, or even month to month. Most research programs require steady, long-term funding, yet the chances of obtaining grant renewals or completing research projects can fluctuate greatly. This unpredictability disrupts research, hurts morale and performance, and leads researchers to spend

more and more time writing and peer reviewing cant proposals. Can efforts be made to provide researchers with more constant funding?

Answer. The issue raised by this question is crucial, but it is important to recognize that unpredictability of funding is experienced at the investigator level, not in the aggregate. Federal funding of research increased steadily in the past few years. The pool of researchers and quality proposals, and the costs of research, however, are expanding more rapidly than the research budget. The increased competition for available funds results in: a) a lower percentage of accepted proposals, despite their rising quality; b) smaller grant sizes; c) more proposal writing (and reviewing), which drains energies; and d) falling morale.

There is no easy solution to researchers' funding problems. I intend to give this issue my full attention.

Question 9. NSF has predicted a shortfall of 675,000 scientists and engineers by 2006 as a result of the decrease in the college-age population in the 1990s. A shortfall of some 9,000 PhD's is anticipated by 2000. The situation is aggravated by the accelerating pace of retirements from academia. By 2000, about one-third of the current faculty will have to be replaced. How serious a threat is this shortfall to U.S. leadership in science and technology? What steps do you believe that the Federal government industry, and universities should take now to prevent such a severe shortfall in the years ahead? In particular, what steps do you believe that the Federal government can and should take in order to ensure increased participation in science and engineering by women, minorities, and the disabled?

Answer. Supply-demand imbalances are to be expected in a dynamic economy, and scientists, engineers, and students contemplating careers in those fields are subject to market fluctuations. Many groups have disputed the NSF analysis to which you refer, but it does highlight some important steps that need to be taken in science education.

As our economy recovers, the market will create new opportunities for those with science/engineering degrees if their training is sufficiently broad to provide them with the skills needed for a range of positions outside of traditional research and teaching in academic settings.

Question 10. The deplorable state of science and mathematics education in this Nation threatens our future well-being. Several Federal R&D agencies, recognizing the seriousness of the problem, have instituted both pre-college and university-level programs to attempt to upgrade teacher skills, develop new curricular materials, and increase the interest of young people in pursuing careers in science or engineering. What role should the OSTP Director play in coordinating and advocating federal programs to improve science and mathematics education? What level of priority in the Federal R&D budget should science and mathematics education programs command? Is greater Federal support needed for undergraduate scholarships and graduate fellowships for students in science, mathematics and engineering?

Answer. The new jobs created by an expanding economy in 1993 and beyond will be different from the jobs available to earlier generations. Most of the new jobs will require a solid command of basic skills in mathematics, science, and technology. Demand for scientific and engineering professionals will also increase. Economic progress that can be shared by all Americans demands that all workers have the technical skills required by this new economy. This means improving the way science and technology are taught in K-12, enhancing science and engineering programs in our colleges and universities, and ensuring that training opportunities are available for people already in the workforce. OSTP will make this goal a priority. It will also work to ensure that new information technologies are used to increase the productivity of learning and teaching and put to use wherever they are appropriate.

The FCCSET Committee on Education and Human Resources has identified agency programs at each level of the education process and has begun to coordinate resources and efforts through a five-year strategic plan. I am convinced, however, that there is still more the Federal Government should do. I expect to explore these issues—particularly with regard to historically under represented groups (women, racial and ethnic minorities, and physically disabled students)—in the early months of my tenure at OSTP.

Question 11. In recent years, the Federal government has not had a coherent national space policy. Ambitious goals have not always been matched by realistic budget requests, and no true consensus exists on future goals and programs. If confirmed, what role do you expect to play in setting national space policy? In particular, what will be your relationship with OMB? What are your thoughts regarding the priorities that should be pursued by the National Aeronautics and Space Administration (NASA)?

Answer. The Nation has been highly effective in using the space program to demonstrate technological mastery. But its structure and focus were generated by the Cold War. As we redefine our national goals, I will help the Clinton/Gore Administration examine the links between the U.S. space program and national goals in security, environment, science, add various areas of the economy.

Question 12. During the 1980s, research programs at the National Oceanic and Atmospheric Administration (NOAA) have faced budget cuts far worse than those suffered by many other Federal agencies. Yet NOAA's scientific and environmental monitoring programs play a central role in the Nation's global change research program and other scientific efforts. If confirmed, what will be your recommendations concerning NOAA's research programs?

Answer. NOAA supports a range of research projects that have been important for understanding the impact of human activity on the environment and the impact of potential mitigation strategies. They have developed computer models vital for understanding global warming and the cause of the ozone hole. We depend on NOAA to monitor the Earth's environment and provide and keep track of such things as changes in the Earth's temperature, indicators of global change, and changes in the Earth's protective ozone layer. Unfortunately, the importance of this seemingly mundane research is not widely recognized and NOAA's research budget has declined during the past five years. In my view, this decline is ill-advised. NOAA's research is critical for developing well-balanced, cost effective environmental policy and for giving us early warnings about the successes or failures of our programs.

The CHAIRMAN. Very good, and we would welcome them to the committee if they are here along with Mary Ann.

Dr. Gibbons, we need you immediately as a critic, because we have been trying to get into the field of technology competitively. We had a very good and responsive initiative by our ranking member, Senator Danforth here, with respect to semiconductors.

I read an article last month where we are coming back because of Sematech and the Government initiative, but otherwise there has been just a stone wall against the Government. You know, that was a whole animus up here for the past 12 years, get rid of the Government. The Government was the problem and not the solution.

With that particular mindset we have had a next-to-impossible task to get going, which to many of us on the committee seemed very obvious, specifically in the field of technology, to try to get into the private or domestic side of technology as compared to the defense side.

DARPA has over the years done an outstanding job. We worked early on some 5 years ago with Craig Fields over on the defense side and with our own Bureau of Standards within the jurisdiction of this Commerce Committee, and then came upon the idea of the land grant colleges, where years back we created the various universities research centers, the extension services, the experimental stations, and America's Government assisted—let us put it that way—agriculture as the world's leader.

We say we do not have industrial policy. We have got one in agriculture, we have got one in aircraft. All the research is there, but this crowd would come just like monkeys on a string. Oh, industrial policy, we cannot have that. We cannot have that—private sector, private sector.

That is not the world today. All governments are in action to compete. None of us particularly relish that. We would like a totally private approach, but living in the real world, unless you can assist particularly small business, they will never be able to com-

pete to commercialize the technology that is discovered, and we find that all the scientific endeavors are going offshore.

The supercollider and other things down in Texas, they win the Nobel prizes, but the Japanese we always said win the profits, because they orchestrate in order to go in and commercialize.

In that vein, in 1988 we put onto the trade bill a provision that upgraded our Bureau of Standards into the National Institutes of Standards and Technology, and we came along with the advanced technology program, the manufacturing centers, and then the extension services from those manufacturing centers.

I noted in the campaign whereby we have 7 centers now, friends of the President in private sector like Scully of Apple and Young of Hewlett-Packard backed Mr. Clinton's proposal to create 170. Well, obviously we are not going to get 170, but they had a very strong, ringing endorsement of this particular approach.

We tried with our bill last year, and we passed it through the House and Senate. We called it the National Competitiveness Act. It was to develop further the technology. We have already introduced that particular measure this year as S. 4, and we have merged therein Senator Gore's bill that many of us on the committee cosponsored with respect to so-called highway of computer communications, where we could get the optic fiber links and everything else to sort of connect, computerwise, communicationswise, the entire Nation.

Look at that S. 4 for us right away critically, because we will start hearings on it, and we would like your expert advice. I think it is a sound approach. From what I have heard from the administration thus far, they think so, too, but if there are any amendments, or if we are headed in the wrong direction, now is the time to repair it.

Do you have any comments about this, whatever? I know you know something about it, because we consulted with you for the past several years. This is like Plato's famous couplet, the politician makes his own little laws and sits attentive to his own applause. Let us, you and I, clap for each other. But tell me what you think of that really, now. [Applause.]

Dr. GIBBONS. Let me first tell you that I believe Vice President Gore and President Clinton are responding quite positively to the concepts embodied in S. 4. The bill brings together some well-considered ideas, and we look forward to working with you on them.

I promise you that I will look very carefully at the bill and provide any comments about sins of omission or commission. I believe it is an excellent start in a very important direction.

The CHAIRMAN. Very good. Thank you. Senator Danforth.

Senator DANFORTH. Dr. Gibbons, congratulations. Have you had an opportunity to read the report of the President's Council of Advisors on Science and Technology on research-intensive universities that came out last month?

Dr. GIBBONS. I have seen the report. I have not digested it yet, Senator. I understand generally its contents.

Senator DANFORTH. OK. I would like to just ask you about some of the points that are made in the report and ask you if you have a view as to their soundness and what direction, if any, we should take from the suggestions.

The first has to do with infrastructure needs of our research universities, and it is pointed out in the report that there is a great need for laboratories and equipment and so forth at our universities, and just in part the report says:

The Federal Government should establish a temporary nationally competitive merit review program of grants for repair and renovation of the physical infrastructure of university-based research such as building specialized equipment and computer networks. The program should operate on a 50-50 matching basis with non-Federal funding. The size of the program should be commensurate with the repair and renovation needs. Recent estimates place those needs at more than \$4 billion.

Then it goes on to say, "the competitive merit reviewed programs should make funds available only to institutions that pledge to forgo funds earmarked for award without such review."

So, this really raises several issues: One, is there a significant need for renovating and improving the infrastructure for university research?

Two, should the Federal Government be involved in this with a significant number of dollars?

Three, should any Federal effort be on a matching grant basis; and

Four, what do you think about merit review as opposed to earmarking, and should any such Federal program be conditioned on the recipient university's foregoing earmarked funds for research?

Dr. GIBBONS. Senator, you have raised some very important questions. I have the following conviction: when the graduates of American graduate schools encounter in their first jobs new equipment that was unavailable to them in their graduate studies, it is a clear sign that the infrastructure of our graduate schools is falling short of the mark and a signal of great concern.

I also believe that higher education is a public investment as well as a partnership with the private sector and philanthropic funding. We have recognized higher education as a public responsibility since the establishment of land grant universities. It is a part of our national culture.

I am sympathetic with the concept of matching funds. Matching helps create new avenues of dialog. Challenge grants are well-known, successful ways of drawing resources together from a collection of interests, and I cannot say at this point that I would have objection to matching grants.

Resources may or may not be available through that process, but we can try and see what works.

I believe merit review is terribly important. Resources must fall to the best ideas. At the same time, we need to cultivate the opportunity for building new, great institutions around our country, not just in certain key historic centers.

That brings up, of course, the question of earmarking, which has been a problem. Earmarked funds still represent a small fraction of all research grants, but it has been growing very rapidly in absolute quantity of dollars and also as a percent of the total grants.

One can argue that earmarking is an important mechanism to help sustain and bring along second and third tier universities in their research capabilities. Unfortunately, a substantial portion if not a majority of so-called earmarked funds have gone to the large universities, so the present practice of earmarking is not nec-

essarily going to fix the issue of helping build the lower tier universities.

I think there is a problem, and I certainly look forward to reading that PCAST study very carefully and trying to build on it. I think you have raised some very important points, and I intend to pursue those ideas.

Senator DANFORTH. Thank you.

The CHAIRMAN. Senator Krueger.

Senator KRUEGER. Thank you very much, Mr. Chairman.

One of the things that I was particularly pleased to hear was to hear my chairman mention both Sematech and the superconducting supercollider.

I wonder whether you might give me your perception of the importance of each of those in terms of our national scientific efforts, Sematech particularly, as it emphasizes the conversion from basic science to technology and tries to have our industrial sector work together to be internationally competitive, and the superconducting supercollider in terms of what this can or cannot mean for world science?

Dr. GIBBONS. The Constitution talks about science and the useful arts, which gave rise to the ideas of intellectual property protection and patents. The language expressed a historic and continuing commitment of the American people to support and to invest in innovation.

Sematech embodies the useful arts. It represents a confluence of public and private interests in turning important new scientific ideas into technology that in turn goes back and helps science moves ahead.

Sematech now shows clear signs of being a very successful public investment in developing generic technologies that will enable American entrepreneurs and innovators to move new products into the marketplace. I think Sematech and other similar ventures, such as the Battery Consortium, are important examples of public-private risksharing.

Such efforts should be considered as experiments. We should evaluate how well they are working.

The superconducting supercollider is designed to be at the front edge of world-class science, to promote understanding of the ultimate nature of reality, the ultimate nature of matter. It may enable us to reach even farther back toward that moment of the so-called big bang and understand what happened at the time. It is a very exciting frontier of good science, and to that degree it seems to me we should all be proud of this kind of activity.

Of course, the problem with the superconducting supercollider is that we have not been able to engender as much international financial support as we would like to see. This kind of large science is inherently an international enterprise, and we must make an effort to secure multinational funding if the effort is to succeed.

Senator KRUEGER. Well, I do not wish in any way to be provincial, but I would certainly be pleased to have your active support of getting international support for what is, as you say, a world-class project, and I would hope that we could count on that from your office.

Let me just ask, if I might, one other question. How much time am I normally allowed?

The CHAIRMAN. Go right ahead.

Senator KRUEGER. I would like to ask, in terms of where America fits in world examinations with regard to the scientific capacity of our young children? We hear consistently that we are behind countries like Thailand in mathematics and areas like that.

I realize that you have other responsibilities, but I am just wondering whether there is anything that you have to offer for America generally in terms of how we might keep America as the world's scientific leader by developing the young people, and developing young scientific talent?

Dr. GIBBONS. I would like to make a couple of responses to that, Senator. First of all, in the world that our children face, more than the present world, intellectual development to the fullest capability will be essential for two things.

One, to compete with people around the globe for resources; and two, to obtain a high quality of life and to create a world we can be proud of and pass on to later generations. An increasingly important component of citizenship is the ability to understand quantitative things, like mathematics, and to understand the world about us as it affects our lives—that is, science and technology.

Without an understanding of this process, our children are enormously handicapped. It was not quite so important decades ago, but it is now absolutely essential now to citizenship and gainful employment.

We have not given math and science education the kind of attention and investment they require in the classroom or in the home. The classroom can do only so much in a child's education. As much or more depends on a child's environment outside the classroom.

Education starts with the families, with their support and encouragement of children to gain quantitative skills. It continues with the companion job of equipping our teachers and our classrooms with the capabilities now provided by technology to assist in this learning process.

We all have a job ahead of us, and I cannot think of anything more fundamental or important in our Nation's future, in our long-term future, than investing in our children and raising them to their fullest potential.

Senator KRUEGER. Thank you. Thank you very much. Thank you, Mr. Chairman.

The CHAIRMAN. Very good. Senator Burns.

Senator BURNS. Thank you, Mr. Chairman. Again, Dr. Gibbons, thanks for dropping by yesterday. And as you know, this field of technology covers everything from the environment, to space, to biomedicine, and the like. It is a broad range of areas of which we will be conducting research and development. And I am wondering, have you had the opportunity to sit down and talk to your boss about his priorities, or this administration's priorities and goals that have been set for this Office of Science and Technology Policy?

Dr. GIBBONS. I spent an hour with President Clinton in December as we talked about this. I think I have an understanding of his concern, and I was pleased that he put out my name as early as he did. That was on Christmas Eve. He and Vice President Gore

even got me on a plane with Vice President Gore back to Washington in time to sing in a choir that night, so they helped family values quite a bit by getting me back to town in time.

I have spoken most recently—yesterday—with Vice President Gore about these issues. I sense they are going to place a heavy load on me because they feel that science and technology will be a fundamental component of the administration's attempt to develop options to enable our Nation to recover economically, and to prepare the seed ground for the years ahead.

I was pleased this morning, also, that the President signed an Executive order yesterday that places me in the core group of the National Economic Council, chaired by Bob Rubin. I believe they understand that science and technology are intimately related to our national economic agenda.

Senator BURNS. But you did not talk about any particular field of endeavor, whether it be the biomedicines or the biochemistries?

Dr. GIBBONS. No, we have not gone into that detail yet. I think they are probably waiting for me to come forward and give them what I think is my best shot. I hope to put a plan before them in the coming weeks, not months.

We will have a retreat at Camp David this weekend, the White House senior staff. And some of these issues of technology, as it arches across the various executive agencies, will be part of the discussion over the weekend.

Senator BURNS. I would hope that high technology is going to play a role, and will continue to play a role in those industries so that we can compete in an international economy and enhance our competitiveness in this country. Senator Gore and I—or then Senator Gore, Vice President Gore now, and I introduced legislation calling for the development of advanced, broadband telecommunications infrastructure connecting all homes, businesses, libraries, medical facilities, schools, and this type of thing, and getting those onto a broadband network by the year 2015. And we introduced that legislation last year.

If confirmed, what would you do to promote that American technology? And, more specifically, do you support and would you actively encourage the development of a broadband information highway as the Vice President Gore and I have proposed?

Dr. GIBBONS. I think your proposal is on target. As we rebuild our infrastructure, we typically think of bridges and highways, but we must also consider the information infrastructure. The use of that infrastructure is expanding at extraordinary rates because it makes people more productive, reduces the costs of services, and enhances peoples' lives. One example is the Internet system, which was sponsored by the Federal Government, picked up by the private sector, and is now expanding at a rate of 10 percent per month.

So, the question is how to combine the resources and capabilities of the private sector with the public sector to enable dissemination of this technology to people in the big cities and in the countryside. Your physical location should not preclude access to the opportunities that come from information?

You and I discussed yesterday the fact that telecommuting is an increasingly important opportunity for many Americans who can

choose where they wish to live and take their work with them. We have many opportunities here, Senator. The question is going to be how to work out just the right combination of public and private involvement to make the thing work best.

The Federal Government must also think about the vehicles—meaning the computer and telecommunications equipment—that move on the information highway. Useful equipment will ensure that our schools, our libraries, our hospitals, all benefit from improved information infrastructure. I would be much happier seeing the highway expand as the demand pulls that highway along, rather than first create a highway and then look for some riders, or users.

Senator BURNS. Well, I believe that there is a heavy implication because you have done some work in the areas of energy and energy efficiency, and we know that that problem still faces this country. Sixty-five percent of our balance of payment on the negative side is the importation of energy into this country. We are still reliant on foreign sources. This has to be addressed. And I think it has great implications in the environmental world on how many automobiles we can run, how much fossil fuels we can burn. So, your area here and the research you have done here, I would hope that this office would take a look at and continue that research.

Also, in the areas and the production of food and fiber, biosciences, and our ability to produce and do research work in the areas of pests and weed controls, of areas necessary because we still have to feed and clothe a growing society of over 200 million people. Our landmass and our ability to feed and clothe ourselves is still going to be one of our basic necessities. And I would ask for that same research.

We have also had some concerns from some scientists about your attitude toward animal experimentation, using animals in experimentation, and how that has affected some of our research. There are interest groups outside the government who have an agenda of doing away with the use of animals in our research. What is your personal opinion about animal rights groups and their effect on the public opinion? Has it affected our scientific community?

Dr. GIBBONS. Shall I respond to your last question?

Senator BURNS. Whatever.

Dr. GIBBONS. I am deeply interested in the Native American concept of the use of animals. When the American Indian killed an animal for its food and shelter, the Indian always said a prayer of thanksgiving to that animal for having given up its life so that the person might live. I think we sometimes do not give enough attention to that notion of the ethical use of our power over the rest of the world.

I use animals. I raise cattle. I understand and appreciate the importance of the use of whole animals in doing whole body research. However, we showed in an OTA study several years ago that there are an enormous number of technologies that now make it possible to do testing, research, and teaching without having to sacrifice animals the way we once did.

The marketplace is now responding, because it turns out to be more effective and less expensive. Technology is replacing many traditional uses of animals, such as for testing foods and cosmetics.

I applaud the application of thoughtful, high technology to substitute for animal use.

I do not believe that we should avoid using animals entirely. I think that is simply not defensible. That is the best way I can respond to you, Senator.

Senator BURNS. Thank you, Mr. Chairman.

The CHAIRMAN. Dr. Gibbons, as you know Senator Gore headed up our Subcommittee of Science, Space, Technology, and did an outstanding job. And now, Senator Rockefeller will be taking over that subcommittee and doing an even more outstanding job. Senator Rockefeller.

Senator ROCKEFELLER. Thank you, Mr. Chairman. I did not know that was ratified until this moment. [Laughter.]

Dr. Gibbons, with or without the ratification I cannot tell you how happy I am that you are going to be in this position. Just as Chairman Hollings and the rest of us on this committee feel that the Commerce Department itself is tremendously capable, tremendously powerful, tremendously influential should it choose to be, it has basically been in the backwater for several decades. And now we have a Commerce Secretary who I think is going to be the best we have ever had.

I feel exactly the same way about the position that you are going into. I think there have been some very, very good people that have preceded you. But either for reason of a sense of distance on the part of the Presidency about the whole field of science and technology, space less so, and the possibilities of all that and the intellectual curiosity for all of that, I think the science advisor has been enormously underused.

And I cannot think of any appointment that the President has made that I think holds out more promise for moving this country forward, as we say, and doing so in an intelligent, technical, scientific, and humane ways, all of which are within the purview of your office.

One of my questions, as you know, is going to be about the National Economic Council because we all know that industries make investment decisions not just on science on technology but on trade policy, and tax policy, and economic policy, and a whole lot of other things. And there you are going sit, on that board. I mean, that is a first. That means you are integrated in the broad decisionmaking power of the Government. Your voice, which is strong and experienced, will be heard. And I think that is, again, a very wise decision on the part of the President that you would be sitting there.

So, please understand how happy I am about you and about what you have done since 1979 for us and for the years before. I really think this is an important chance to move forward with an administration that feels passionately about science in technology. Anyway, that is my bias, as I am sure you understand.

Dual-use technology will be controversial. And we use that word now, and the American public is gradually beginning to understand what its meaning is. But, in fact, the research that Government agencies do with R&D dollars is not particularly respectful of or mindful of other possible uses. In fact, it is usually customized to a particular use of an agency.

Now, I think the idea that all technology that the Government buys or anything to do with has to be with dual uses is theological and improperly so, and dogmatic, and silly. On the other hand, simply talking about dual use technology and allowing it to mean-der through the processes of government, we could end up, even though we understand the importance of dual use technology, with not have some kind of a system or some kind of a discipline, organized discipline which really measures it at the highest levels.

So, let me ask you sort of an exaggerated question. Do you think that what we ought to do is to adopt, in fact, a Governmentwide policy, say, that would develop dual-use technologies. But that in cases where it would not be appropriate to so do, that there would be a high-level decision made that it would be so appropriate. So that, therefore, the bias away from dual-use technologies, the instinctive bias away from dual-use technologies, has to go through some sort of a discipline?

Dr. GIBBONS. Senator Rockefeller, historically, there has been approximately a 50-50 mix of investments on the defense side versus the civil side. In recent years, military took more like 70 or 75 percent of funding. We are trending back to 50-50, which seems an appropriate move, but the transition will take some time. I believe a steady increase in the amount of civil technology often feeds defense needs.

For instance, the great advances in microelectronics these days are being driven by the large civilian markets. We used to think about spinout as coming from military research. We find more and more these days that civil sector research spins out ideas and products that are helpful to the military.

I believe productive results might emerge from a change of mind set such as you suggest. When mission-oriented agencies think about how to fulfill their missions related to research and development, the first question they should pose is whether the end-product is obtainable from nongovernmental markets. Can we buy it, rather than learning how to build it? In many instances the answer is yes. The second question is: if we develop this new technology, what other markets exist beyond our own particular agency?

For instance, when a national lab starts to develop a new instrument, they should ask at the front end about opportunities for partnership.

Senator ROCKEFELLER. One more question, and I have an eloquent statement that I hope the chairman will let me put in the record about you.

The CHAIRMAN. If there is no objection.

[The prepared statement of Senator Rockefeller follows:]

PREPARED STATEMENT OF SENATOR ROCKEFELLER

Thank you, Mr. Chairman.

The combination of the end of the Cold War and the beginning of a new Presidency presents to our nation great opportunities in many policy areas. One of the most critical of these is our national science and technology policy. That is why the nomination of Dr. John Gibbons to be the Director of the Office of Science and Technology Policy, and these hearings to consider his nomination, are so important.

The end of the Cold War has made us realize more than ever that it is our economic strength that determined and will continue to determine our nation's ability to provide a raising and sustainable standard of living to our people and will determine our nation's ability to provide leadership—diplomatic leadership, military lead-

ership when necessary, as well as economic leadership—to the people of other nations. Indeed, we now realize that it was our economic strength that enabled us to achieve the geopolitical goals that were for so long our national priority. Our national economic strength, in turn, will be determined by our international competitiveness.

The beginning of the Clinton Presidency is also an important turning point, especially for this committee. It brings to an end the long debate over the wisdom of government action to improve our international competitiveness. For twelve years that debate was largely carried out in Washington. At first the debate was normally partisan, between most of the Congressional Democrats on one side and most of the Congressional Republicans and Republican administrations on the other side. The result was often gridlock. Over the past few years, the debate was more and more between a bipartisan coalition in Congress on one side and the Republican administration usually but not always on the other side. We made some important advancements, with many of the initiatives originating in this committee, but we didn't do enough.

That inside-the-beltway debate became a national debate during the recent presidential election campaign. The American people have ended the debate with a decision. They have asked the national government to end its gridlock. They have asked their government to become more active in promoting our nation's international competitiveness. They have asked their government to become a partner with American workers and American businesses to chart a course of economic recovery and long-term growth.

As a result of that decision, the question before us—not just this morning but in most of our work on this committee—is no longer whether there is a role for government in the strengthening of our international competitiveness but rather how government's role will be implemented. As our international competitiveness is so closely tied to advances we as a nation make in science and technology, a large part of this question will therefore be how government's role in science and technology will be implemented.

The commitments President Clinton made during the campaign and the programs he outlined, especially his September manifesto "Technology: The Engine of Economic Growth" and its companion "Manufacturing for the 21st Century" demonstrated his recognition of the importance of science and technology to our national well-being. That recognition is also demonstrated by his decision to make the Director of the Office of Science and Technology Policy one of the earliest appointments in his administration and by his decision to give that appointment to someone with Dr. Gibbons' exceptional expertise and experience. And I don't mean only his distinguished science and technology background. The fact that he is also an expert in Congressional relations is a special bonus.

I must confess, however, it is with mixed feelings that I consider Dr. Gibbons' nomination to be the Director of the Office of Science and Technology Policy in the White House, to be in effect President Clinton's science and technology advisor. When President Clinton called on all Americans to be prepared to sacrifice for the good of the nation, he could have been thinking about how Congress would feel about giving up Jack Gibbons. I know that I am one of many senators who have counted on Dr. Gibbons over the years for lucid, insightful advice on science, technology, and a whole host of related policy issues. OTA has thrived under his management. He will be missed sorely at OTA but I look at this change as a windfall for the President and the nation.

Jack himself will say that as Director of the Congress's Office of Technology Assessment he was providing the Congress only assessments—scientifically and technologically solid information—not his advice on what to do. I understand that the person in the job Jack has held for so long can remain on the battlefield only if he avoids taking sides in partisan conflict. He did that, and did it very well, despite the pressures we put on him to support one agenda or another. He provided authoritative, accurate and unbiased information that forced us to reach conclusions based on facts and rigorous analysis. To show how important these "only assessments" have been, I want to cite just one example.

When Dr. Gibbons came to OTA, President Carter was proposing a \$100 billion program to produce synthetic fuels from shale. OTA examined the proposal and found many problems in the feasibility of the technologies involved. As a direct result of that assessment, the program was turned down by Congress. The money saved the American taxpayer by that assessment and the consequent Congressional decision was enough to pay the entire cost of OTA for 25,000 years!

Well, Jack, your days of providing "only assessments" are soon to be over. As you make that passage from assessor to advisor, I want you to think anew about one of your favorite maxims, one articulated by Victor Hugo that I have read several

times in your writings: "Science says the first word on everything. And the last word on nothing." As the president's science and technology advisor, you will be much more than a scientist, much more than a technologist. You will be a policy advisor and you will be a policy maker. You will be in a position that—if done the way I believe you will—can be one of the most valuable in our government. You will at times have the last word—if there is such a thing in Washington—on national science and technology policy. Despite my regret about your leaving Congressional employment to take on these new responsibilities, I look forward to this new chapter in your career and to our collective effort to put the country on the economic footing that we all want to achieve.

When we get to the appropriate part of this hearing for questions, I would like to ask you about your assessment and, for the first time, your advice on several science and technology issues.

Thank you, Mr. Chairman.

Senator ROCKEFELLER. I have a number of other questions I may submit in writing, but something that Senator Danforth and I are interested in very much, and others here also, is the question of cost containment in health care.

The proliferation of technology, new machinery, is staggering. Every American immediately assumes that it is his or her right to fully use that technology which often sits, in fact, used only 2 or 3 hours a day but at enormous cost, so just the general question of technology and the science of health care.

Now, that is not a very comfortable or automatic fit with Science Advisor to the President, but in that there is no discipline on the development of technology in health care, much of which, of course, is wonderful, and most of which is wonderful but perhaps not all of which is necessary, and in that President Clinton has called for something labeled a National Health Board which will set a global budget for public and private spending on health care in this country—and in fact the total aggregate public and private spending of health care cannot, under the bill that he will propose, exceed that amount, there is going to have to be some sort of judgment, some sort of discipline, some sort of process that is going to have to look at the technology in health care.

Necessarily, perhaps, not all of that judgment and assessment should come from the health care industry. I do not ask you a question now. I only ask you to think about the possible relationships between the cost containment process in health care, the National Health Board which will be set up to set the global budgets for health care, and the office which I certainly am going to vote to confirm you for as kind of an outside advisor and in a sense a critiquer of public policy, of health care public policy.

The relationship intrigues me. I am not certain what it is. I do know that technology is explosive in health care and driving the cost of health care out of control, and I am not sure that it is all necessary. I would only ask you to think about that. We have until May before President Clinton delivers the health care bill.

Dr. GIBBONS. Senator, I appreciate those comments very much. I intend to spend a lot of time thinking about that topic. If I might, I would add just one or two quick comments.

First, as the distinguished physician, Louis Thomas, has observed, we have developed increasingly elegant ways to diagnose diseases, but we have not learned how to cure them.

Also, the focus of the science part of medicine should be not just how to improve the process, but how to make it more affordable in an economy that, however rich we are, is limited.

So, thank you very much for those comments.

Senator ROCKEFELLER. Thank you, Dr. Gibbons. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Dr. Gibbons.

Two things have come up with respect to the question on animals. I noted on Sunday evening a 60 Minutes program relative to a research project, I think it was in the Department of the Army over in the Defense Department down in Louisiana relative to the human brain, whereby injured soldiers' brain injury, this research physician had gotten into some progress as to treatment using cats, and there was a terrible objection as to how the cat was anesthetized, or put to sleep and otherwise.

Two things hit me, as we are talking about it here, that you might well advise the President I would like to see if what I listened to is correct commenced again and that doctor be able to complete his research, because according to very eminent witnesses there in that particular program, he was onto something, and we ought not to stop it, given your answer on that.

Otherwise, of course, sitting on the subcommittee of Health and Human Resources, I am closing down medical research at NIH. In the past 10 years I have closed down 10 cancer clinics. We have got the human genome study, we have got the Institute of Neurological Sciences, and here I am closing down medical research at NIH, I am opening up over in the Defense Department.

Now, being a politician, I know the answer. We got money in Defense. We do not have money over in NIH. That ought to be rectified. I do not want to stop what is going on over in defense. It seems to be very valid, but in the allocations the President ought to be counseled along that line, and let us get this thing where we have got medical research in the National Institute of Health.

Senator Kerry, you are next.

Senator KERRY. Thank you, Mr. Chairman. Dr. Gibbons, welcome. I am sorry I could not have been here a little bit earlier. I want to welcome you to this new role and thank you for the significant way in which you helped a lot of us in your role at technology assessment to be able to think about competitiveness and to be able to actually frame some of those issues here in the Congress and create some responses.

Obviously, for a State like mine, Massachusetts, your appointment is very, very important to us, and I personally think that your role is one of the single most important that we are confirming and thinking about in the course of these next days.

There has been so much talk and so much written, and you have written—I noticed the list of your articles, better than 130 of them submitted, but so much written about our industry base slide and the problems we face in trying to find new jobs.

In a State like Massachusetts, where biotechnology and advance materials and microelectronics, artificial intelligence, and a whole host of the critical technologies are in fact the base of our high wage jobs and hopefully the base of future jobs for the country, where we are going in this arena is even more critical.

The President has talked about shifting our current 60 percent R&D in the military sector and getting 10 percent of that, so we have a 50-50 split for civilian, providing, I guess, about \$7.5 billion additional to R&D in that field, which will be, I think, critical.

But the question to a lot of us who have been involved in this now over the last years as we have developed a vocabulary and an understanding is really how this is now going to be implemented.

During the campaign, the President suggested that Vice President Gore was going to be able to oversee a large part of this field, and so I would like to just ask you, if you could at this point in time share with us any greater specificity as to:

One, How exactly you see that relationship flowing?

Two, How quickly and in what way do you see this transition taking place of the allocation of resources from the defense sector to civilian?

Three, What will be the framework for the administration?

Therefore, do you see us, for instance, creating a civilian-type DARPA as has often been suggested, or will this simply be channeled through current Department of Energy or NIH framework?

Dr. GIBBONS. On the first question, Senator, I take it that you are wondering about my relation to the Vice President, who has been given very explicit responsibilities by the President in the area of both environment and technology.

I feel fortunate to have known the Vice President for some years. In my discussions with him, which are continuing, of course, I have mapped out two roles for myself. One is assistant to the President—his honest broker on the technology and science perspectives that bear on decisions that he needs to make.

I expect that as Director of OSTP I will be spending a lot of time with the Vice President, particularly on environment and technology. I find this very hopeful, because in times past the Federal Coordinating Council on Science, Engineering, and Technology, which is charged with integrating and coordinating programs across the agencies, has had a difficulties. But the convening power of the Director of the Office and Science Technology Policy is obviously less than that of the Vice President.

So, I hope to engage the Vice President in that process because he is in an ideal position of knowledge and standing to help assure that we can successfully reintegrate these issues across the agencies of Government.

That takes me to the second and third points. Specifically, the shift from a defense-focused research program to civil research is something that is going to have to take place over not weeks or months but years. It would be wasteful in many instances just to chop things off and try to create something new. But it is a shift that is logically being driven by the changing notion of what our national priorities are in the wake of the ending of the cold war.

The idea of a civilian equivalent of the Defense Advanced Research Projects Agency is in some ways appealing, if you think about forming new institutions. But at this point in time, although I want to give it some considerable extra study, it seems to me the most opportune way to go is to fully utilize the resources that we already have.

By fully utilizing, I mean, for example, to introduce new elements of priorities and procedures in the national labs so that the work they do not only fulfills mission-focused activities but also involves joint ventures or joint projects with the private sector. I believe such restructuring can be done on a competitive basis in which the funds will flow to those that have the best idea and the most success in making these transitions.

The expansion of the role of NIST under the Department of Commerce, which has been proposed, is an excellent way to go—expanding that operation and using the advanced research projects that they are doing.

I think we can do a better job of creating competition for funds that flow within the Federal Government to the national labs, for example. The facilities are there, the people are there. They are scattered around the country in a rather remarkable way, and if we can orchestrate those resources—NIST, the national labs, the other Federal resources—I believe we will be a lot better off.

Senator KERRY. With respect to the 21 or so, 21 I guess, critical technologies that we have now agreed on between the Europeans, Japanese, Department of Commerce, Labor, et cetera.

Let us assume that we now do not have this problem of picking winners and losers that has plagued us for awhile. Since we have designated critical technologies, we now want to put some impetus into them. And let us assume that you find a mechanism or several mechanisms which will permit us to do what we seek to do in the Hollings centers, which is facilitate the transfer of technology from laboratory to corporate entity and into the marketplace.

Do you envision either a problem, or if you envision the problem, a solution to dealing with the question of the wholesale movement of that technology to the cheaper labor markets? For instance, you have the development of a new technology, but the company, once it gets it's hands on it, says it is really going to be better for us to manufacture this in China or in Costa Rica, rather than in Flint, Michigan or Brockton, Massachusetts?

How do you guarantee that out of this Government-inspired effort to move technology and to facilitate the process, we will wind up with the jobs without again overly intruding in the market in ways that people hate?

Dr. GIBBONS. That's a very central question. I haven't tied these concepts together as you have, I think so thoughtfully this moment. I think the 21 critical technologies represent fair consensus on the frontiers of research and the most promising opportunities for fruitful technologies to emerge.

As we think about the proper role of Government, however, we must be careful not to focus just on the technologies themselves, but on a variety of interventions that range from tax laws to regulation.

As technologies develop, we must identify what would cause them to move overseas, rather than to move in to some innovative activity here in the United States. It's that downstream issue that we've not been giving attention to here in this past decade or so. And it's really hurting us.

Why is it, for instance, that a Japanese company wants to buy a particular small American firm, rather than that firm either

growing or merging with another American firm? Is it access to capital? Or is it sufficient R&D funding?

Corporate flight in search of minimum cost production is a problem if the value that is fleeing us was developed largely or significantly at public expense. I can't tell you that I know all the answers to that problem. I do know that kind of work will stay at home if the labor force here is equipped to be highly productive and to provide a better job than these folks can get done overseas.

We cannot pay our people less. But we can equip them to be more productive. We still are the most productive country on earth, but the rest of the folks are catching up with us pretty rapidly. Satch Paige once said, "don't look back, something might be gaining on you." In fact, something is gaining on us—the science and the productivity of our trading partners and competitors.

I think we need to pay attention to development of these new ideas and to providing the seed ground in which they can take flower here in the United States and employ American workers.

Senator KERRY. Well, I agree with that. I think it may be necessary for you and the Vice President to think about a more direct connection between the efforts we may make and the responsibilities of companies on the outside.

I do not think it is very mysterious at all as to why these companies are doing what they are doing. I was talking to one CEO yesterday of a major international company based here in this country, but now doing business abroad. And it is very clear. I mean, we have all talked about these on the floor of the Senate many times.

When you add up the environmental requirements, which we ought to place and do place, coupled to the liability and other issues, coupled with wage scales and health care and so forth, most people in this—under the guise of what we call competitiveness are seeking the lowest cost per unit of production.

And inevitably, it is in places that have less of those requirements. So I think as we help companies develop technology, there is going to have to be some standard of reciprocity in their actions so that we do have the high wage jobs here ultimately. Because otherwise I would respectfully suggest we are going to be developing the technology and exporting it even more rapidly.

Dr. GIBBONS. I think you're right, Senator. It just occurred to me also that in other countries that may very well have the same environmental laws, the Government provides more direct assistance to the companies that must implement those laws and put in place the environmental controls. We do well there, for instance, than Germany.

Senator KERRY. Well, that is a whole different issue, but a very connected one. And I have been having some discussions recently with some companies, and clearly, we are going to have address that.

We have got American companies that are producing what most people deem to be an equal product in technology fields. And our own military in now purchasing, because of the low bid, from some foreign sources for those technologies with the result that we are losing the jobs. But if you look behind the veil of the corporate en-

tity that is winning the bid, they are sometimes 70 and 80 percent government-owned or government-subsidized.

And so we are allowing subsidized entities to take American jobs and technology. And then when they have gotten that first foothold, our companies lose the market share as well as the sustainability of their work force to maintain the technology level. And we begin to lose in that field altogether.

And there are areas in submarines, sonar, and other kinds of things that I could point to like that. So, I think it is very important.

I have gone well over my time. I did have another, but I will do it in the next round, Mr. Chairman.

The CHAIRMAN. Senator Danforth.

Senator DANFORTH. Mr. Chairman, I am going to have a few questions in writing to submit to the nominee.

Dr. Gibbons, I would like to just say a couple of comments before I ask you my remaining questions.

The first, in case I was too subtle in asking my first round of questions, my own view is that there is a clear need for increased capital investment in research facilities at colleges and universities. And that the process of earmarking brings the whole concept of investing in those capital needs into disrepute. So, I would hope we would pursue both the capital needs and that we would withstand the pressures for earmarking.

I would also say, just as a comment on the previous line of questions, I myself would be terribly disturbed if the work of the science advisor and the scientific enterprise of our Government were to be conditioned on some sort of commitment with respect to business as to where they locate plants or where they hire jobs. That is obviously an important issue for the country at large.

But I hope that we would not pull our punches with respect to useful research on the basis of any kind of extraneous consideration such as that. That is just my view.

Let me ask you, if I can, a few questions. In the PCAST report, it is recommended that there be a second review of the Federal laboratories. And it is pointed out in the report that there are some 700 Federal laboratories. It is said that the original missions in some cases, in many cases, have been accomplished, that the laboratories more or less go about their business, that they have terrific physical facilities.

What they are doing is not subject to peer review. They become sort of perpetual motion machines. And in the view of the PCAST report, this deserves review.

I do not know if anything is being done. For all I know, there is a review that is already receding. But do you believe that the mission of our Federal laboratories is something that should be reviewed, and that perhaps in some cases they have outlived their usefulness and that they are perpetuating themselves without a clear mission and without any kind of peer review with respect to whether they should be doing it or whether perhaps an university or an industry should be going the work?

Dr. GIBBONS. Senator, I want to spend considerable time reviewing the PCAST report and talking to the members of PCAST that were involved in it.

The Federal labs represent a major public investment in research and development. They merit a constant review, it seems to me, by their own peers. Lots of money flows into 700-odd labs from various sponsoring agencies.

To a degree, we have had reviews every few years, I believe, over the past decade. I think, for instance, of the Packard review of the national labs of the Department of Energy back in the eighties.

Most of those reviews have a bottom line that says the labs' science is very good, very notable. There have been issues raised, however, about how well the information developed there moves not just into the scholarly journals but into technologies and the marketplace.

The mission of the labs is changing very rapidly. I think few would have thought in say, 1988, that we would be where we are now with respect to nuclear arms, for instance, and the need to continue to develop and test nuclear weapons.

Time has caught up very quickly with some of the largest labs; indeed, the very labs that underwent the greatest expansion during the 1980's.

As we review the assets of the Federal system in science and technology, the national labs have to come early on the list of things to look at. How well they may have done in past years may now be irrelevant. It is a question of how well are they doing in light of the new imperatives before us.

I believe oversight of the labs could well benefit from having not just the mission agencies themselves involved, but also some other folks that may well be representative of the kind of downstream customers outside the agency's own missions. It is very important to involve potential customers at the start rather than at the end.

Senator DANFORTH. OK, thank you. I do have a couple of more questions. Could I proceed?

You, Dr. Gibbons, have, on several questions, talked about how research moves into the marketplace and the downstream use of research. And obviously, when you're appearing before a Senate committee, you are going to be asked about how we are going to become more competitive.

You are not, by giving these answers, I hope you are not downgrading the role of basic research in this country.

Dr. GIBBONS. I am glad you raised that question, Senator Danforth, because that would be the last thing I'd want to do. Basic research represents the continuation of our Nation's tradition to explore, to search out new ideas, to gather new knowledge. Time and time again it has lifted our spirits and expanded our horizons as a people. It has made us the envy to the rest of the world. It also has provided us with new options, options that can enable us to have the sorts of things we'd like to have, including material wealth as well as an improved environment.

I am a firm believer in vigorous support of the pursuit of knowledge. And it takes various forms, much of it at the bench, some of it in giant machines. The epitome of the American spirit is to collectively invest in developing new knowledge and then providing a marketplace that can turn ideas into goods and services.

Senator DANFORTH. Mr. Chairman, I have one more question which I would like to ask and then I promise I will leave for the airport and go to South Carolina. [Laughter.]

If they will have me. I just want to read one more sentence from this PCAST report. And knowing you have not studied it in any detail, it is a very general point and it is a point that I have heard from educators.

Here is the sentence. "Various members of the higher education community have described to the relationship of their institution to the Federal Government, particularly as it pertains to the support and university-based research as increasingly adversarial."

Now, I have heard this. We now have new regulations on the indirect cost issue. I know with respect to that whole issue the view was that there was an adversarial relationship to universities.

I had one educator tell me within the last few days that while an audit of a particular department at a medical school did produce some misspent money, even a fair amount, \$100,000 maybe or so—it is not a small matter—but in this person's view, a very distinguished department head, it is morale wrecked by the whole process.

And I think that it is possible to be so adversarial, so anxious to audit, that we build in the sort of view of the world that is represented in the New York Times editorial page, that there are just a lot of evil people out there that have to be unmasked and found out and investigated.

And there are. There is no doubt about it. But sometimes you can throw out the baby with the bath. And oftentimes, you can. And I think in this country, one of the concepts, it seems to me, is that we don't meticulously root out every conceivable evil that we destroy people and we destroy institutions in the process.

And I am wondering if you have, in your own experience, noticed or heard of a concern that the Federal Government is viewed as being an adversary, that basically it is kind of a search and destroy mission. How can we uncover all of these evil people out there in the university community or in business who are doing research, root them out, audit them, reaudit them, send in the auditors, ask a bunch of questions, hold congressional hearings, humiliate them in the press, destroy them, with front page articles and of course, New York Times editorials?

And before you know it, instead of having a country which is both decent and forward moving, we are just involved in a lot of inquisitions.

Dr. GIBBONS. I think you have touched on a very important point that I will have to spend more time on in the months ahead. I have three brief comments in response.

One, we must remember that universities are not out there making money as many other Government contractors are. They are not only not for profit, they are money-losing organizations. In most universities tuition is but a small fraction of the real cost of educating. The rest comes from donations and grants. Universities differ from institutions out there making money off the Federal Government.

At the same time, there is, I think, legitimate concern that some universities' overhead costs have gotten out of hand. Researchers

themselves are very unhappy when they cannot compete because their overhead costs are so high. Some of the concerns about increasing overhead charges were raised in defense of researchers who were finding themselves carrying such an increasingly heavy administrative burden with universities.

Third, I think there has been recent movement toward simplifying the methods for calculating and establishing overhead rates—OMB Circular A-21. These methods need to be more uniform so there is less room for error and arbitrary judgment calls. I hope we can work hard on this issue, but remember that the universities are our partners with the Federal Government. I hope the notion of some adversarial relationship can be quickly removed, and we can get back on track as a true partnership. Thank you.

Senator DANFORTH. Dr. Gibbons, thank you and congratulations on your nomination. We look forward to a very early confirmation. And Mr. Chairman, thank you, and members of the committee for your patience.

Senator KERRY. Mr. Chairman, could I just—

The CHAIRMAN. Thank you very much, Senator Danforth, and the record will stay open. Let me get the partners, where I find a conspiracy, and get to the not money making, where I find money wasting. After all, we have got a lot of these universities that are buying yachts and putting on wedding receptions in the name of science, on the one hand.

And I have fought continuously, and this town has come to town now, and unless you are from Oxford and Yale, I do not believe you are going to have a chance for the simple reason that they have got the peers. That is all I hear about, peers. Now, we have put in peer review with our manufacturing centers and everything else, and it is well conceived. But on the other hand, that is crowd that has conspired together as partners over the years, and it is hard to break in.

And I wish you would at that peer review crowd, because they have sustained themselves, which has in turn constituted tremendous waste and misallocation. Otherwise, I am in lockstep with Senator Danforth on the orchestration. And I will be a little bit more direct.

Dr. Gibbons, you are in competition with the movements that are now ongoing on the Hill here with respect to research moneys. The national labs are not in basic science, and they are out, like you said, and looking for an accident for happen. They are looking for a mission. And I have actually been approached in own backyard and said, now wait a minute, out there at Los Alamos they are getting together and they are making up projects because they have got the money and they want to hold the money. So, why do we not get some of that.

Or, otherwise, in agriculture, with research, you have got the energy, and now nuclear with the end of the cold war is diminished, of course. And we have got all that money in energy. We do not want to let that get out of my energy subcommittee of appropriations. I want to be able to spend that money. I do not want to see it allocated to basic research. And similarly, in the defense appropriations, I want to continue to get into the brain and medical research, and everything else of that kind.

Orchestrate—you are going to hard time keeping your head above water to get ahead of us right up here on the Hill because we have got the money, we have got the subcommittees, and we have got the budget. And you are going to submit one here in a month. And you had better be looking at that, because we will make projects for it, and then you will find, like when we increased the National Science Foundation, they were studying the habits of insects and all these kinds of things that the New York Times does write about and it embarrasses us all.

So, get going on that one. I mean, it is not anything to sit back, and review, and study, because we are already moving. We are finding projects, and we are listed out, and everything else of that kind up here. And it will not get into NIH and it will not get into basic science. It is going to get into specific projects all over the countryside. That is how the Louisiana brain project found itself in the U.S. Army budget. I mean, you might as well look at things as they are. Excuse me.

Senator Kerry, Senator Krueger was ahead of you.

Senator KERRY. I just wanted to clarify something for the record. But Senator Danforth has left, and I wanted to clarify it for him, but I will for the record, anyway.

The debate over this relationship between the Government's role in technology and the private sector is going to be difficult enough without beginning by drawing the lines in ways that I do not see them drawn. And I just wanted to clarify for the Senator that I am not suggesting that we ought to be telling private sector companies precisely where they can or cannot do things, although I will point out that the current rules on joint research agreement between the national labs and industry do require production here in this country.

I am simply trying to point out that we need to think, as a Nation, about those other things in the equation which will make it more likely that the jobs that are created are going to be done here. And one of the things that you can compare, for instance, are the cultural differences between ourselves and either the Japanese or Europeans in their entire approach to workers, and job training, and education, and so forth.

So, I think there are many things that we can structure that will make it conducive for people as we engage in this relationship, without necessarily setting up rigid requirements that are totally contrary to our concept of free market and so forth, or to how we work best.

There is a balance, but if we do not think about it, then we are going to have a trickle-down high-technology policy which is not going to satisfy anybody, and an awful lot of it is just going to be running abroad.

The CHAIRMAN. Senator Krueger.

Senator KRUEGER. Thank you, Mr. Chairman. I have one question and one brief comment to make before going, but first the question. The lady who sent me here, my Governor, would definitely want me to be certain to ask about the space station. Do you view the space station and future space technology as an area where the United States can continue to lead, or is this a leadership position that we should give up to other nations? And to what

extent can we count on other countries continuing to share some of the costs of that program? Where would it be in your priorities?

Dr. GIBBONS. Like superconducting supercollider, the space station is a very, very large enterprise in technology. The space station, in my view of things, is not so much science as it is an application of technology. And the larger such a project gets, the more properly it should be thought of as international venture.

At the same time the space program, beyond the space station, includes development of some things that are very central to our national security as well as our national economic enterprise.

So, I must provide a mixed response. There are certain things in space science and in very large projects, like the space station, that I believe inherently call for an international venture of humankind. On the other hand, there are certain space technologies that need to be very much our own purview. The mixture has to be determined with project-by-project specificity. Is that response to your question?

Senator KRUEGER. Yes, that addresses it. And I would just say, Mr. Chairman, that I was struck as I listen to Dr. Gibbons' testimony—I thought back to I guess it was C.B. Snow who wrote about the two cultures a long time ago. And it seems that anyone who can quote from Oliver Wendell Holmes and Satchel Paige is showing some merging, at least, of the two cultures, or maybe more than two. And clearly a person who has the capacity not only to understand the range of scientific endeavors in which the country is involved but also one who can communicate it to the country in a very effective fashion.

And I could not help thinking, as you were sitting here—and you felt, evidently, that your previous experience had prepared you for this moment. And there is marvelous passage in Churchill here he writes about, in his history of the Second World War, when finally it seems that they have turned to him at the time of need. I think that you might want to consult that. But he feels that all his experience prepared him for this moment.

And it seemed to me as though the tremendous range of experience that you have both in the academic world, in your work at the OTA, and throughout have really prepared you in a very unique way for this position. And I am delighted that the President has recommended you for this position. I think it was an outstanding appointment. Thank you very much, Mr. Chairman.

The CHAIRMAN. Very good. Senator Kerry.

Senator KERRY. Thank you very much, Mr. Chairman. I will just be very quick. I want to ask you two questions, if I can.

One, the Office of Technology Assessment last year put out a report dealing with the subject of NAFTA. And in the report you said, "if done right NAFTA will increase jobs, raise wages, improve conditions. But if it is implemented the way it now stands it could depress wages, lose jobs," and so forth. You suggested, therefore, that it needs some changes.

Do you stand by that report? And if so or if not, how do you see yourself having an impact with respect to the President's suggestions that there might be some side agreements needed to implement it properly?

Dr. GIBBONS. The OTA analysis provides options, but it also presents the finding that the NAFTA is a necessary but insufficient condition for a full, fair trade agreement. That is, there are some other things we are going to have to do as a Nation to hold onto our job markets, our own economic growth, our own self-interest, while we open our markets to other countries.

OTA found the job begins with an agreement like NAFTA but it does not end there. If it does end there, then we have some trouble.

Senator KERRY. Have you been specifically asked to be part of a group with respect to the suggestions that are going to be made on it, or do you expect to play into that?

Dr. GIBBONS. I would hope so, but it is still too early to tell exactly how this is going to work out in the administration. I would presume that the National Economic Council will have to wrestle with some of these issues.

Senator KERRY. On another issue, I gather somebody asked about this prior to my getting here, and that is the question of the national information infrastructure. The tensions that now exist around that center around a lot of nervous telephone companies and some questions within the computer companies. Do you anticipate, perhaps, bringing them together fairly soon to try to talk that out and proceed forward on it? Or what course of action would you see to try to move forward on the idea?

Dr. GIBBONS. I would certainly like to gain firsthand the perspectives of the stake holders, as we traditionally did in OTA. It is so easy to misunderstand something without talking to the key stake holders. My own personal education on that, I hope, will include some direct conversations with the stake holders just to make sure I understand their positions; not just where their concerns are, but what they believe they can bring to the national table as we move ahead with developing this infrastructure as a key part of the groundwork for the next move of our economy.

Senator KERRY. So, I read that to say that there is some flexibility. You are open to them showing you that there might be a better way or a different route. Is that correct?

Dr. GIBBONS. Absolutely, Senator.

Senator KERRY. Finally, one of the areas that most concerns me is environmental technology. Vice President Gore and I went down to Rio last year and were just stunned to find about 700 Japanese companies down there, all formally accredited to the UNCED conference. And there were only 35 companies from the United States, one-half of them, I might add, were from Massachusetts, gladly.

We have got about 1,300 companies now involved in environmental technology, and it is an increasing job base of significance. It will probably double in the next 3 years to about 70,000 jobs. Do you view this realistically as a major potential area of job growth in the United States? And do you anticipate yourself trying to play a very active role in encouraging people to understand this opportunities better?

Dr. GIBBONS. "Green technology," it has sometimes been called, is a very important new opportunity for people and for industry to apply advanced technology in the provision of goods and services with fewer undesired environmental side effects. I think we have

to overcome a kind of a different perspective here in the States from the way, for instance, the Japanese look at this.

The Japanese came pouring into Rio because they see the new groundrules, the new rules of the road of environmental protection, as driven by very fundamental human desires across difference economies and cultures. They see a global phenomenon, and an important new market opportunity that they can meet with products.

DeTocqueville once said that "the thing to do is to discern the inevitable and then exploit it." And that is just what the Japanese have done, I think. They have discerned the inevitable. And we still tend to be thinking about environmental technologies as an extra cost, add on, downward pulling sort of activity. I do not think that is true. I think the Japanese were closer to the mark, and I think their turnout at Rio was a sign that we ought to be thinking a little bit more in that same way.

There are a lot of opportunities there. There are a lot of markets, not just here in the States, but around the globe, because it is a global phenomenon.

Senator KERRY. Well, point of fact, in the last few years, the last 10 years or so, we have gone from being the world's leader in a number of those technologies, and we have ceded that lead to the Japanese and Germans. And our own reluctance to move forward on clean air standards has seen both of those countries, Germany and Japan, putting in stringent requirements which has raised the state-of-the-art in those countries so that now all of your Eastern European, and Southeast Asian, and other countries that are looking for that technology are looking to those countries rather than us for those purchases. So, there is a direct loss of business to the United States by virtue of this. Would you agree with that?

Dr. GIBBONS. Indeed. The United States is importing a lot of the environmental control equipment for our own scrubbers. They are coming from overseas.

Senator KERRY. I see this as an area—I mean, if you look at the estimates, it is going to be a \$200 billion growth to \$300 billion in the span of 10 years. There are a lot of jobs there for Americans. And I certainly hope that you will move aggressively in this position, as I am sure the Vice President intends to, to help American industry to latch onto this and understand it.

Dr. GIBBONS. Thank you, Senator. I do firmly believe that the kind of confluence of advanced technology, sophistication in providing goods and services with less of an environmental impact, is an important way for us to think about our future. That matches the U.S. idea of leadership. It seems to me we have an opportunity to regain that leadership in these areas and move ahead. And it will not happen automatically, but it is an enormous opportunity.

Senator KERRY. Just very quickly, what would you say are the most promising of the 21 critical technologies, as we have designated them, if you were to give us a sense of job possibility for this country?

Dr. GIBBONS. Well, I have often said that our future lies more in inner space than it does in outer space. As we learn more and more about how things work and what they are like down inside solids, and on the surfaces of things, and between atoms, there flow technologies like microelectronics, lasers, and other things.

We still know not very much about how things work down there in inner space. So the so-called dense matter physics and chemistry are going to continue to be, I think, a wellspring of new opportunities for us, as well as new, fundamental understanding of what we are made of.

Senator KERRY. I appreciate that. Mr. Chairman, thank you very much.

The CHAIRMAN. Thank you very much. Dr. Gibbons, the committee appreciates your appearance here today. The record will stay open for further questions.

We hope on Thursday, when we have a quorum and mark up for our rules and organization of our subcommittees, that we will take up your nomination and confirm it and report it to the floor of the Senate. And that is at 11 a.m. on Thursday.

The committee will be in recess until that time.

[Whereupon, at 11:55 a.m., the committee adjourned.]

APPENDIX

PREPARED STATEMENT OF SENATOR WARNER

Mr. Chairman, and members of the committee, I am pleased today to introduce to the committee Mr. John H. Gibbons of The Plains, Virginia, who has been nominated to be Director of the White House Office of Science and Technology Policy.

Since 1979, Mr. Gibbons has been the Director of the Office of Technology Assessment of the U.S. Congress. The Office of Technology Assessment is a bipartisan agency of the Congress created to serve as its principal source of expert analysis on issues involving the impacts of science and technology in our society.

During the years of 1974-79, Mr. Gibbons was a Physics Professor at the University of Tennessee. He was also the Director of the Energy, Environment, and Resources Center at the University. During the years 1973-74, Mr. Gibbons was the Director of the Office of Energy Conservation at the Federal Energy Administration.

Mr. Gibbons also served as the Director of Environmental Program at the Oak Ridge National Laboratory during the years 1969-73. During the years 1954-69, Mr. Gibbons also served as a physicist and Group Leader, Nuclear Geophysics in the Physics Division at the Oak Ridge National Laboratory.

Mr. Gibbons is an internationally recognized scientist who is an expert in energy and environmental issues. His past public sector advisory activities have included chairmanship of the Demand/Conservation Panel for the National Academy of Sciences Committee on Nuclear and Alternative Energy Systems and membership on the Energy Research Advisory Board of the U.S. Department of Energy. He has served on the Board of Trustees and Board of Associates of Randolph-Macon College, the Board on Science and Technology for International Development of the National Academy of Sciences and the Board of the American Association for the Advancement of Science.

Mr. Gibbons is a graduate of Randolph-Macon College and Duke University where he received his Ph.D. degree in physics. He is a fellow of the American Physical Society and the American Association for the Advancement of Science. Mr. Gibbons is married to Mary Ann Gibbons and they have three children named Virginia, Diana, and Mary.

Mr. Chairman, given the extensive scientific background which Mr. Gibbons has developed throughout his career, I do support his nomination to be the Director of the Office of Science and Technology Policy. I hope the committee will give his nomination the utmost consideration for this position and that the full Senate will receive his nomination and report favorably to the President.

Mr. Chairman, may I add that Mrs. Gibbons is a descendent of the first Chief Justice, John Marshall.

POSTHEARING QUESTION ASKED BY SENATOR PRESSLER AND ANSWER THERETO BY DR. GIBBONS

LANDSAT

Last year Congress passed the land Remote Sensing Policy Act of 1992, which I authored. The new law revitalizes the Landsat satellite program by returning important functions to the government. NASA and the Department of Defense are scheduled to launch U.S. Landsat 7 in January 1990. Because landsat data is so important for global change research, the new law also restores emphasis on making this data available to scientific researchers and public users. South Dakota's EROS Data Center will be the primary data processing center for Landsat 7.

Unfortunately, the Landsat 7 program is threatened. The House and Senate Appropriations Committees have denied NASA's request to reprogram \$15 million for the Landsat 7 program. NASA has \$10 million for Landsat 7, but needs \$25 million in order to fulfill its responsibilities established by the land Remote Sensing Policy

Act of 1992. If NASA does not get the full \$25 million, DoD will not be able to spend an of the \$84.8 million earmarked for LANDSAT after May 1, 1993. I wrote to Senator Barbara Mikulski (Chair of the Appropriations Subcommittee on VA, HUD, and Independent Agencies) expressing my concerns. In her response, she said that the Committee on Appropriations would be working with the Clinton Administration to review this matter.

Question 1. Are you aware of this problem? Do you support full funding of the Landsat program? Can I get your assurances that you will bring this issue to the attention of President Clinton?

Answer. I am aware of the problem faced by reduced funding for LANDSAT 7. I share your concern that adequate investment in remote sensing is crucial for global change research, resource exploration, and many other purposes. During the next few months, I hope to work closely with both the President and the Vice President reviewing U.S. priorities in space science and global change research. I can assure you that the need for LANDSAT 7 will be given careful attention as a part of this review. I hope to have the assistance of the Commerce Committee and other Congressional Committees in this important work.

POSTHEARING QUESTIONS ASKED BY SENATOR BURNS AND ANSWERS THERETO BY DR. GIBBONS

Question 1. The Clinton Administration has indicated a commitment to make science and technology policy a priority. However, science and technology policy covers an ever-growing range of issues—from space to biomedicine to the environment. If confirmed, what priorities and goals would you set for the Office of Science and Technology Policy (OSTP)?

Answer. If confirmed as Director of OSTP, one of my primary goals will be to help this Nation must better link its scientific and technological enterprise to national goals. Science and technology have much to contribute to achieving President Clinton's stated goal of reestablishing the strength and resilience of the American economy: the development and adoption of new technologies by U.S. businesses can create attractive new job opportunities; advancing learning technologies and complementary curricula and standards can ensure that all Americans have access to the skills in mathematics, science, and technology needed in a modern economy; and new technologies can contribute to rapid economic growth while limiting unwanted environmental impacts. Science and technology also have much to contribute to other national goals, such as improved health care and environmental quality.

To help ensure that science and technology fulfill their potential in national affairs, I will work with the President, the Vice President, and the Cabinet members toward the following priorities:

- preserving U.S. leadership in basic scientific research;
- better integrating environmental and economic goals (on a national and international level) and developing strategies for reaching those goals;
- establishing the Federal Government as a leader in resource efficiency and sustainable living; and
- educating and training the American population in preparation for the 21st Century.

Question 2. Under the 1976 Science and Technology Act which created OSTP, the President may appoint up to four Senate-confirmed Associate Directors to assist the Director in his duties. Does the President intend to appoint four Associate Directors and, if so, what will be their areas of responsibility?

Answer. I have not yet had an opportunity to review my proposed reorganization plans for OSTP with the Administration. It is my hope to reorient the Associate Directorates, as permitted in the enabling legislation, to be more directly responsive to the key areas of emphasis the President has outlined to the American people. I will be happy to share with you and the Committee the structure we anticipate after it is settled.

Question 3. In the past, the role and responsibilities of the Director have very much been a function of the personality and vision of the person occupying the office. If confirmed, what will be your role in shaping and planning science and technology policy for the Clinton Administration?

Answer. The job of the Director of OSTP is to provide scientific and technical support for the President. This Administration has outlined an ambitious vision of America's future—particularly the creation of good jobs in a growing and competitive economy—that is critically dependent on science and technology. I believe that my experience and background will bring an important perspective to the develop-

ment and evaluation of Administration programs to make that vision a reality in what will clearly be a team effort.

TECHNOLOGY POLICY AND U.S. COMPETITIVENESS

Question 4. A recent GAO study indicated we are losing ground to foreign competitors in all but one of eleven high-tech industries. In addition, other countries, particularly Japan, are doing a much better job at bringing new inventions and discoveries to the marketplace. As Director, what programs and policies would you advocate to turn this situation around?

Answer. I strongly support such federal efforts as the High Performance Computing initiative, the NREN program, cooperative programs such as Sematech, and technology transfer programs such as the Hollings centers. I believe that an educated workforce, industry and government cooperation, and a healthy investment climate all serve to promote economic growth in the private sector where we must look for job creation. A robust basic research and technology development enterprise is a fundamental ingredient to this nation's future. I intend to promote it.

Question 5. In recent years, various agencies and institutions have developed lists of critical technologies that will dominate the world marketplace in the foreseeable future. I happen to believe U.S. leadership in communications and computer technologies is absolutely crucial to our future. Dr. Gibbons, what would you view as the top five most critical, commercially relevant technologies at this time? Do you believe these critical technologies deserve special funding and support in the federal budget?

Answer. I agree that computers and communications, which are so intricately linked to modern economic activity, belong on any nation's short list as keys to growth. As I indicated in my testimony, I believe that research into the inner world of the physical and biological workings of things, at the cellular, molecular, and atomic levels, holds the keys to many important opportunities for mankind. It is also clear we need to develop production systems and new fuels that allow our economy to expand without burdening the environment. While it is clearly important to establish priorities, and I would like to discuss these priorities with you at length, I am reluctant to specify a specific list of the most important five technologies. The range of economic, environmental, and security challenges that require advances in science and technology is very broad. We must advance along a broad front.

Question 6. We spend almost \$80 billion a year on federal R&D, with 60 percent going toward defense and 40 percent devoted to civilian purposes. President Clinton has indicated he wants to increase the civilian share of that budget to "stimulate non-defense technologies." Do you have any specific ideas about how the Administration might accomplish this?

Answer. The Clinton/Gore Administration will offer a range of policies designed to stimulate non-defense technologies and business innovation and growth throughout the economy. These policies will be defined in consultation with industry, but some existing government programs do have important roles to play.

For instance, NIST has played an active and important role in developing technologies that help our industries compete and help ensure that all American businesses, particularly small businesses, have practical access to innovations. Technology programs at NIST and elsewhere need to be carefully coordinated with research programs conducted throughout the government. They also need to be better interfaced with private industry.

Increased technology activity on the civilian side is particularly important in ensuring continuity of support for research and development as defense budgets decline. We will also need to find improved ways to use the resources at our national laboratories to support civilian technological and scientific research. OSTP can play an important role in accelerating and coordinating this thrust across the government.

Stimulating technology requires more than increasing federally sponsored research, however. It also requires policies and programs that encourage higher levels of private spending in research and development and that encourage U.S. businesses to move quickly to invest in innovation. We must also ensure that U.S. students emerge from school adequately prepared to participate in a sophisticated, fast-moving economy and also that people already in the workforce have access to the training needed to keep pace.

Question 7. The Clinton-Gore policy paper on manufacturing calls for creating 170 "market-driven manufacturing centers to help small- and medium-sized manufacturers." How much would this proposal cost and how would you decide where to locate these centers?

Answer. Many factors, e.g., the level of services provided, the amount of cost-sharing with States or localities, will determine the ultimate cost of these centers, and I cannot answer your question with precision at this time. NIST uses a very effective, "bottom-up" method to locate centers right now: they take proposals from existing institutions or from institutions that would like to exist, thus they respond to the needs of interested parties. This method deserves careful consideration as the Clinton/Gore Administration goes about developing the manufacturing technology extension centers.

SPACE

Question 8. NASA is a great source of national pride. Every year, our space program achieves goals in space science and exploration that other countries can only dream about. Space Station promises to move our space program to the next level. However, I understand that in 1984, under your leadership, the Office of Technology Assessment issued a highly critical study on Space Science and that, in general, you are skeptical of "big science" programs. Do you support the Space Station program and what are your views on other big science programs like the Superconducting Supercollider and Mission to Planet Earth?

Answer. "Big science" projects generally serve more than one goal, and science is but one voice among others in the final determination on relative merit. Organizations like OTA and OSTP can help ensure that accurate, impartial information is available to the elected officials who must weigh many factors when determining which projects to support. I believe that the "bigger" a project is, the more appropriate it is to look for international support for the effort, and to use the willingness of other countries to commit resources as one gauge of a project's usefulness. Projects like the Space Station, the Superconducting Supercollider, and the Mission to Planet Earth promise to extend the frontiers of science, but at great expense. The Clinton Administration must work closely with the Congress to determine which "big science" projects best further our societal goals, including the pursuit of knowledge, and what level of U.S. funding they deserve.

Question 9. What do you think should be the goals and priorities of our space program? In your view, what are we doing wrong and what are we doing right in our space program today?

Answer. The Nation has been highly effective in using the space program to demonstrate technological mastery. But its structure and focus were generated by the Cold War. As we redefine our national goals, I will help the Clinton/Gore Administration examine the links between the U.S. space program, including the Space Station, and national goals of security, environment, science, and various areas of the economy. Only when those links are identified will it be possible to answer the question of right and wrong directions in the space program.

SCIENCE

Question 10. There is little question that the U.S. possesses the greatest scientific talent and resources in the world. Often, however, our scientific enterprise is not sufficiently aimed at meeting the needs of American industry. If confirmed, what measures would you advocate to refocus the research of our labs and universities?

Answer. The U.S. system of universities and national laboratories represent a critical national asset. We cannot afford to let our lead in science, mathematics, and engineering deteriorate further. While priorities in pure science are driven in large part by the scientific community itself, our investment priorities in engineering and applied science must reflect changes in national needs. The U.S. finds itself with a new range of security problems, new competitors for international markets, and new concerns about the environment. U.S. research priorities must be modified to reflect these new needs. The basic missions of some of our national laboratories will need to be changed in the years ahead. Some difficult choices will be needed. I hope to be able to work with the Commerce Committee in the difficult task of shaping the federal research portfolio to reflect these and other new priorities.

Question 11. Many analysts have warned that the United States may be facing a scientific manpower shortage by the next decade. We simply will not have enough scientists and engineers to do the research necessary to maintain a strong technology base. What thoughts do you have about generating greater interest among our young people, particularly at the K through 12 level math and science?

Answer. Many analysts dispute the notion that a scientific manpower shortage will manifest itself in the next decade. Supply-demand imbalances are to be expected in a dynamic economy, and scientists, engineers, and students contemplating careers in those fields are subject to market fluctuations. But that does not diminish the importance of generating greater interest in and knowledge of math and science

in our population, especially since most of the new jobs created in coming years will require a solid command of basic skills in mathematics, science, and technology. New teaching and learning technologies—particularly computing and telecommunications systems—help capture students' imagination and sustain an interest in science in a way that the typical classroom experience may not. They enable students to actually "do" science—participate in experiments, workout hypotheses—and to learn at their own pace. I look to these new techniques with enthusiasm and intend to explore them at OSTP.

COMMUNICATIONS AND COMPUTERS

Question 12. As we close in on the 21st Century, high technology is, and will continue to be, one of the key industries for U.S. competitiveness. As you know, during the last Congress Senator Gore and I introduced legislation calling for development of an advanced, broadband communications infrastructure, connecting every home, hospital, school and business in the U.S. by the year 2015. If confirmed, what would you do to promote American technology, and more specifically, do you support, and would you actively encourage, the development of a broadband "information highway" as Vice President Gore and I have proposed?

Answer. The Clinton-Gore Administration is committed to expanding Federal programs to help industry develop and apply new technologies. In Germany, Japan, and most other developed countries, a much larger portion of the government's R&D budget goes to the development of civilian technology. In contrast, here in the U.S., government research dollars have gone mostly for basic research and defense technology programs. During the campaign, President Clinton issued a comprehensive policy paper on technology that, among other things, calls for creation of a 21st Century infrastructure, including a broadband national network.

The creation of a national "information highway" would yield huge benefits by increasing productivity, accelerating the manufacturing process, providing more people with access to quality health care, improving education opportunities for both children and adults, and delivering entertainment, information, and other services more quickly and more cheaply. Unfortunately, deployment of such a national network is being stymied by telecommunications policies that have not kept up with the new technology. And because there are so many Federal and State agencies involved in setting telecommunications policies and so many vested interests reluctant to change those policies, we are faced with a policy gridlock.

Breaking that gridlock will require two things: 1) defining a vision of what this country's telecommunications infrastructure could and should be; and 2) building a consensus to change the policies and make the investments needed to build that infrastructure. The President and the Vice President intend to do just that. The Office of Science and Technology Policy has two roles to play here, ensuring that Federal networking and computing technology R&D programs are well coordinated, well run, and well linked to industry, and ensuring that the agencies primarily responsible for telecommunications and information policy are fully aware of the latest developments and trends in computer and telecommunications technology.

TELECOMMUTING

Question 13. "Telecommuting" or using telecommunications technology to work from home, can provide at least a partial solution to a number of energy and environmental problems. For example, if more Americans used technology to work from their homes—thereby removing the necessity of physically traveling to their place of business, we could avoid the crushing economic and environmental costs of continuing to use our already overburdened transportation infrastructure, and see a decrease in the dependence on foreign oil. In fact, studies have shown that more than \$23 billion may be saved annually by substituting telecommuting for as little as 10-20 percent of the activities that now require transportation. If confirmed, will you support telecommuting as a policy option to address these issues, and if so, what specific steps will you take to actively encourage and promote telecommuting?

Answer. Telecommuting, which will contribute to reduced congestion of the transportation system, is one of many important justifications for the rapid deployment of a national, high-speed telecommunications network. The present telephone network does not enable the kind of high-speed computer and video links that most people would need to work effectively from home. We should, however, be careful not to overestimate the potential for telecommuting to reduce the environmental impacts associated with commuting by automobile.

As Director of OSTP, I will oversee the interagency committee responsible for the High-Performance Computing and Communications Program, which is already demonstrating how such networks can improve the productivity of researchers and edu-

cators around the country—enabling them to collaborate more effectively with their colleagues, operate research equipment thousands of miles away, log onto supercomputers around the country, and tap thousands of different computer databases. That program is paving the way to development of a public-switched high-speed network that every American could use for telecommuting, for entertainment, for teleconferencing, and for hundreds of other uses.

ANIMAL RESEARCH

Question 14. Dr. Gibbons, as you know there is a continuing debate over the use of animals in scientific research. Researchers themselves must work to educate the public and create opportunities to talk about this issue very clearly and directly. What is your personal opinion on the use of animals for scientific research and experimentation? Do you think the White House Office of Science and Technology Policy can help the research community better inform the public about how and why animal research is performed, and what steps will you take to do so?

Answer. My personal opinion is that in certain circumstances it is essential to use whole organisms in scientific research because many phenomena are so complex that one must study the whole animal. In other words, the whole is greater than the sum of the parts. I also believe that ethics—our responsibilities as human beings as we exercise dominion over the earth—must be brought to bear on this issue. I have a deep appreciation for the Native American practice of offering a prayer of thanks to any animal that gave its life to help a human survive, and believe that this sensibility can inform our current practices. OTA showed in 1986 that advancing technology and scientific sophistication now allows testing, research, and teaching (that once required whole animals) to be done effectively and more economically without using animals. I believe that the use of whole animals, especially the more neurologically complex species, should continue to be permitted, but on the basis of carefully drawn need. When substitutes (e.g., in-vitro testing for regulated substances) are available, they should be favored.

The OTA Report on Alternatives to Animal Use in Research, Testing, and Education (February 1986) is widely used by both the animal user community and the animal rights community. Abuses are evident on both sides of the issue. It is particularly incumbent on the animal user community to carefully monitor themselves against abuses. And the animal rights community needs to become more familiar with the extraordinarily humane outcome—for all animals, including humans—of key “whole animal” research. I believe that OSTP could play a greater role to play in helping the research community communicate its activities and goals—including animal research—to the public. I intend to focus on this area in the months to come.

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